J. Nelson Spaeth

JOURNAL OF FORESTRY

DECEMBER, 1926

Vol. XXIV. No. 8

Published by the

SOCIETY of AMERICAN FORESTERS

Single Copies Sixty-Five Cents Four Dollars per Year

ANNUAL MEETING OF THE SOCIETY
DECEMBER 29-30, PHILADELPHIA, PA.

SOCIETY HEADQUARTERS

Hotel Stephen Girard 2027 Chestnut Street

Single Room $3.00 Double Room $2.00, $2.50 and $3.00

Banquet at Hotel Maryland, Wednesday Night

JOURNAL OF FORESTRY

A professional journal devoted to all branches of forestry

EDITED BY THE EDITORIAL BOARD OF
THE SOCIETY OF AMERICAN FORESTERS

The Journal appears eight times a year monthly—with the exception of June, July, August and September.

The pages of the Journal are open to members and non-members of the Society.

Manuscripts intended for publication should be sent to Raphael Zon, Lake States Forest Experiment Station, University Farm, St. Paul, Minn., or to any member of the Editorial Board.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Subscriptions, advertising and other business matters may be addressed either to the Journal of Forestry, University Farm, Saint Paul, Minnesota, or to Atlantic Building, 930 F Street N. W., Washington, D. C.

JOURNAL OF FORESTRY

VOL. XXIV DECEMBER, 1926 No. 8

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

THE EDITOR'S SILVER JUBILEE*

BY SAMUEL T. DANA

President, Society of American Foresters

On July 1, 1926, Raphael Zon, editor-in-chief of the Journal of Forestry, completed 25 years of continuous service in the United States Forest Service. In celebration of that service, 26 of his friends gave a dinner in his honor in Minneapolis on the evening of October 15. A book of letters of appreciation and congratulation, bound in flexible green leather and inscribed "To Raphael Zon, Forester and Friend, from his Associates, 1901-1926," was presented to him by Dr. Henry Schmitz, head of the Minnesota Forest School. In these letters, glowing tributes were paid to Mr. Zon's service to forestry by his many friends from one end of the country to the other, and even from abroad. Mr. Zon when called on said in part:

"The reason I accept this fine tribute so freely and without assumed modesty is because I feel that it is not personal to myself, but rather to the movement with which I have been identified. I am simply a historical accident. I just happened to pass along when the 'Big Parade' of forestry began. I fell into the ranks and have marched with the column ever since. Any man in a big movement, even the

* The responsibility for printing the first three articles in this issue and for giving them the prominent place to which the subject matter does not entitle them, *does not lie* with the Editor. With poor grace he hides himself behind the following *command* from the President of the Society: "Here are three articles which I am sending with *strict instructions* as President of the Society to use at *the beginning of the December* issue of the Journal of Forestry. While such instructions, no doubt, technically exceed the control which the Constitution gives the President over the Editor-in-Chief of the Journal, you might just as well submit gracefully. Otherwise, it will be necessary for me to get the other members of the Editorial Board who do have real authority to issue them instead. It is not often that we have an opportunity to tell the Editor of the Journal in print what we think of him. . . ."

creators of it, must inevitably become its creatures and partake of its spirit. The enthusiasm, the missionary spirit which you generously attribute to me are really an integral part of the movement itself. One had to possess these qualities if he was to keep pace with the movement.

"The first period in the forestry movement may be characterized by great spiritual richness, the spirit of the proselyte and the missionary. It was not so much a period of the development of technical forestry or the collection of scientific facts, but rather a period of political and economic reform which resulted in the birth of a new idea of orderly public housekeeping. Although it would not be fair to say that some advancement has not been made in technical forestry, yet the qualities that were most prominent were those of human understanding applied to the solution of the thousand human problems which arose as a result of a change in the national policy toward the public domain, and above all the spirit of public service.

"We are emerging now from this period; the National Forests are an established fact, the new relationships except for an occasional flare-up have been accepted by the people. The era of the technician, of the forest manager, of the scientific worker has arrived. This is both an opportunity, and also a possible danger for the forestry profession. If the first period was characterized by excessive enthusiasm and human qualities, we must guard against the new one becoming too technical, too detached from life, and too narrow in its point of view. It is essential that the forest technician never lose his human touch and that, on account of the forest, he should not fail to regard human welfare, and also that he should not cease to see the forest on account of the trees and the logs in them."

The two articles which follow have been prepared as another means of recognizing the distinguished leadership which has marked the first 25 years of Mr. Zon's professional career. Their publication is evidence of the fact that the editor of the Journal, with all his authority, is still not powerful enough to prevent members of the Society on an occasion of this sort from using its pages to express their opinion of him as a forester and a man. In addition to his other achievements, no one has been more keenly interested in the Society or has done more to advance its interests. On this, his silver jubilee, the entire membership of the Society joins in congratulating him on a unique record of friendship and accomplishment, with the sincere hope and confident expectation that the next 25 years will be even brighter and more productive than the past.

A QUARTER CENTURY'S ACHIEVEMENT

By W. B. Greeley

On July 1, 1901, Raphael Zon entered the Forest Service as Student Assistant, at a salary of $25 per month. Four and one-half months later he graduated from "Student" to "Laborer," and his pay envelope swelled to bursting at $40 monthly. On January 1, 1902, Zon attained the dignity of Assistant Forest Expert, but his services, it seems, were still rated with those of a laborer in the matter of wages. Nevertheless, that title of "Expert" must not be overlooked at the beginning of a scientific career. From its acquisition, at least, is supposed to date the famous gray frock coat which contributed in no small degree to Zon's reputation as a savant.

And so the formal record goes. We find Zon a Forest Assistant in 1904; and in 1907, Chief of Silvics, in the palmy days when the classical atmosphere pervaded the halls of the Atlantic Building at all costs, and our official rolls contained Xylotomists. Seven years later Zon became Chief of Forest Investigations; and after another lapse of six years, Forest Economist. In 1924 he went back to the soil, so to speak, as Director of the Lake States Forest Experiment Station.

During 22 of these 25 years I have had a great deal of personal association with Zon. It comes back to me through many vivid recollections—tramps in the woods, debates innumerable on the whole gamut of human, scientific and political interest, long delightful evenings of talk and tobacco at his home, punctuated by cups of tea from the enormous shining samovar. All of the older men in the Forest Service, and most of them in the profession at large, recall Zon's brilliant addresses at "baked apple" meetings in Mr. Pinchot's home, his deft pricking of bubbles blown from superficial notions, his frequent challenge of entrenched theories, his fresh attacks on old problems, his dreams and visions startling in their clarity and foresight, and above all the magnetic stimulus of his enthusiasm. Everyone has shared in these contacts with Zon. He is universal in his interests, in his acquaintanceships, and in the subjects dealt with by his pen. The sum total of his scientific work and leadership is enormous; but it is no disparagement to his more tangible achievements to say that Zon's greatest contribution to forestry is the stimulus and enthusiasm and inspiration which he has always given to other men. He has the rare magnetic qualities of a great teacher; and there are not many men in the forestry profession of the United States today who do not bear personal witness to them.

No one is more widely identified with the technical side of Ameri-

can forestry than Zon. From his earliest years in the Forest Service, he has broken new ground in every direction. Now a study of loblolly pine in Texas; then a silvicultural plan in the Sierras; and again the establishment of sample plots in New England. Zon dipped into forestry problems on almost every part of the map, and always with a vital and stimulating touch. Wherever he went he started something —set trains of investigation in motion, created the beginnings of local silviculture, put men's minds at work.

Zon's personal contributions to American forestry are enormous, but of greater consequence is the spirit of research which he instilled in a rapidly expanding organization of young foresters. And how Zon fought for it in the days when most of us were enthralled with the glamor of our new administrative jobs and prided ourselves on being men of practical affairs! In the years when the energies of the Forest Service were so largely absorbed in the task of creating and organizing National Forests and the "Use Book" was our Bible, Zon never suffered the white light of research to glimmer out. He was everywhere, fanning it and rekindling it. He was always about, challenging our methods and conceptions, giving us new visions of what lay ahead, and stimulating fresh inquiries into things that we needed to know about. To him more than any other man belongs the credit for holding the Forest Service true, during the strenuous period when administration was the absorbing thing, to its fundamental conceptions and obligations as a technical organization.

It is no disparagement of the brilliant individual work of earlier men, like Dr. Fernow, to say that Zon laid the foundations for the investigative work of the Forest Service in silviculture. And this he has done, not so much through his own scientific contributions, large as they are, or his official positions as chief of investigative activities, or the significant developments in research organization which he launched, like the beginnings of the regional forest experiment stations some 12 or 14 years ago. It was done much more largely through the research spirit and enthusiasm which he created and through the men whom he inspired and trained.

At practically every forest experiment station today there are men who were stimulated and taught and brought out by Zon. He gave them the divine spark. He was their scientific leader, their father confessor, their drastic critic, and their close personal friend—all in one. He created around him a group of enthusiastic young foresters, infused with the spirit of technical investigation, who have largely

formed the core of the silvicultural research of the Forest Service as it has grown to its present proportions. And his influence in these ways has extended far beyond the Forest Service, reaching many other groups of forest students and forest workers.

That one man could do this and at the same time carry such a breadth of personal interest and activity in all the ramifying fields of American forestry is an amazing tribute to Zon's vision and mental capacity. I suppose Zon has done more than any other one man in the Forest Service to develop research technique. Yet we never think of him as a laboratory investigator. His contributions to forest economics, his prodigious work on the forest resources of the world, his active part in the discussion of public forest policies, his handling of land and agricultural problems, have all marked him as a leader of the broadest vision. His contact with these problems has never been that of a dilettante but rather of a dynamic personality, challenging and stimulating and catalyzing ideas. And it has all been tempered with an astounding fund of human understanding and human sympathy. Zon is equally at home in councils of learned scientists, in the lumber camp and in the settler's shack. Everybody who knows Zon thinks of him first in terms of personal friendship—friendship never lessened by the rough and tumble of debate or the keenness of caustic criticism. Lumbermen who are shocked by his philosophy welcome him to their homes with open arms. The sheer humanity of the man is after all his greatest quality.

All of these things were strikingly demonstrated when Zon went to the Lake States three years ago. He went back to the woods. He jumped heart and soul into diverse forestry problems of an enormous region. He started all sorts of productive lines of investigation, but he became much more than a Director of an Experiment Station. His magnetic touch was quickly felt in almost every phase of forestry in the region. He is at one and the same time a scientific leader, a propagandist, and a friendly counselor on an innumerable range of individual and regional forestry problems. At no time in his 25 years of professional work have Zon's all-round qualifications for inspiring leadership been more admirably displayed.

An article like this usually reads like an obituary or a speech delivered in the presentation of some suitable keepsake to a prominent man upon his retirement from active work. But Zon is neither dead nor retiring. The best part of it is that he is just in the full prime of his scientific and intellectual and magnetic power. Everyone in the profession wishes him 25 years more of still greater achievement.

RAPHAEL ZON—THE MAN

By Edward Richards

"TELL HIM NOW"

"If with pleasure you are viewing
Any work a man is doing,
If you like him or you love him, tell him now;
Don't withhold your approbation
'Till the parson makes oration
And he lies with snowy lilies o'er his brow,
For no matter how you shout it
He won't really care about it;
He won't know how many teardrops you have shed;
If you think some praise is due him
Now's the time to slip it to him;
For he can not read his tombstone when he's dead.

More than fame and more than money
Is the comment kind and sunny,
And the hearty, warm approval of a friend;
For it gives to life a savor,
And it makes him stronger, braver,
And it gives him heart and spirit to the end;
If he earns your praise, bestow it;
If you like him, let him know it;
Let the words of true encouragement be said;
Do not wait till life is over
And he's underneath the clover,
For he can not read his tombstone when he's dead."

—Author Unknown.

To adequately portray the character of any ordinary person is a considerable task, and one requiring comprehensive intimate information and ability to write. But in addition there is something more needed. This something is hard to define but includes deep, sympathetic understanding, and a taste for digging into motives and searching out the workings of other peoples' minds. Few people, therefore, seem well fitted to write biography, even of every-day folks. When the subject of the biography, however, is brilliant, many-sided, very actively minded and original, it takes a genius to properly deal with even a brief character sketch. It has seemed best, therefore, to make no attempt at a comprehensive character study, but merely to paint a few word pictures and bring out a few statements of friends about Raphael Zon, the Man.

To begin with, Zon has always aroused my intense respect not only as a forester, a technician, and a scientist, but also as a man with honest, wholehearted, fearless convictions for which he had the courage to suffer, if it was necessary. His daring as a youth to defy the powerful government of Russia under the Czar, and throw in his lot with some

of the poor, oppressed people, who were suffering so horribly under the iron heel of that merciless despotism, even though it meant serious trouble for himself, has always excited my heartiest admiration and respect. For down at the bottom of his character Raphael Zon has that quality so supremely honored the world over, and perhaps best expressed in the unlovely Americanism of "Guts."

Next to his honest, fearless power of conviction, one of Zon's most attractive characteristics is his ability to take care of himself effectively and pleasantly in the midst of an argument or when being "joshed." An excellent illustration of this is as follows: A good sized group of foresters, including Zon, were sitting around a camp fire in the Adirondacks. Zon's and Sparhawk's "Forest Resources of the World" had just been completed. In order to tease Zon, various remarks were made about where and how the statistics in the book had been collected and prepared. Statements like "We know figures do not lie, but liars sometimes figure" were made and a general attempt to "kid" Zon began. Suddenly Zon spoke up—"You know, fellows," he said, "this book is only a beginning, a target to shoot at. If any of you can find errors and mistakes in it, we will be delighted to have you point them out to us, so that a second edition can be more accurate." After this the "kidding" abruptly subsided.

Perhaps as noteworthy as any of Zon's characteristics is his vision or imagination, especially when combined, as is not infrequently the case, with his power to enthuse, energize and stimulate others. In this connection a number of those who attended the Toronto Annual Meeting of the Society will remember how Zon collected a number of us together one evening and although it was late and we were gravitating toward bed, waked us up and aroused our interest and enthusiasm about the subject of Forest Research. One can not be near Zon for long without feeling this urge and it calls to mind the saying: "If there is any fire in you, things will warm up when you come around." Zon has plenty of this vital fire and he is most generous in passing it on to others.

Closely associated with the ability to inspire and stimulate is a characteristic of Zon's which is sometimes a bit over-whelming. This is his ability to criticize searchingly not only another's professional work or statements but one's innermost motives and secret purposes. He is very shrewd in his judgment of others' characters, and not infrequently quite outspoken about it. And yet his judgments are never made with ill will or bitterness for through them all there runs a clearly visible silver thread of friendliness, and it is easy to see that his statements are

not made for the pleasure of hurting, but with the purpose of helping, arousing and driving away all sham, pretense and self deception. For Raphael Zon hates bluff, insincerity and four-flushing with all his heart.

On the other hand Zon will not hesitate to say a word of praise when he thinks it is deserved. To illustrate: Last December at St. Paul, the Minnesota Section Meeting had just closed. A good deal of talk had taken place, but most of us visitors were tired. As we rode down to Zon's house in a car, he suddenly turned on me and said: "Ned, you usually talk logically but tonight your talk was rotten." I thought he probably was pretty nearly right and therefore took it as a deserved and well meant correction. Later, at the house, I felt called upon to express my appreciation of Sam Dana's speech at the Section Meeting which had been splendid, even though Sam was exceedingly tired. Quick as a flash Zon spoke up—"Now you are really saying something, Ned" was his emphatic comment.

One of the most searching tests of what a man is made of is the impression that he makes on those he works with daily, especially those who have worked at the same tasks and perhaps under his authority and supervision. It is, therefore, fitting to include the following statements as an illustration of what his contemporaries think of their fellow-worker or their boss:

Director C. G. Bates of the Rocky Mountain Forest Experiment Station writes: "Of course, we all love Zon because of his extreme simplicity. I take it this is the best evidence of his genius and true intellectual capacity. Out of the latter arise not only his professional achievements but also his keen understanding of and sympathy for humanity. When one talks to Zon about his own work and worries, he may feel pretty sure that Zon sees the whole picture,—not only the technical aspects but the personal aspects. It was this understanding which made his leadership in the pioneer investigative work so real and so valuable.

"On the other hand, Zon is very much an idealist and in that sense impractical. Certainly one would not say that he had not the ability to be practical. Rather one would say he would not stoop to the exigencies of practical situations; would not play the game as it is played. I imagine he has changed somewhat in recent years in this respect, since it seems that he has become quite a successful politician in a broad way. He always did rather enjoy political maneuvering and was constantly prying into motives; one could hardly criticize him for this as a selfish purpose was never evident."

C. R. Tillotson, forest inspector of the Northeastern States under the Clarke-McNary Act writes: "I was very closely associated with Zon for a number of years in the Forest Service. As a matter of fact, I was initiated in the Service under his supervision and can not speak too highly of his mental activity and his inspirational qualities. He was a splendid teacher. He, of course, had the background which gave him a much keener and more comprehensive insight into the possibilities of forestry and of the steps which must be taken in this country to bring about the solution of the forestry problem in the United States. He was keenly alert mentally and full of the restlessness of the crusader. He imparted this same spirit to a large extent to his associates and particularly to his subordinates. It was something inherent in his nature and meant, of course, a continual striving for advancement of any cause in which he was interested, particularly in this case of forestry in the United States. It also meant that he was usually several thinks ahead of what could be accomplished because of practical considerations. That simply added fuel to his unrest. Zon's accomplishments, of course, in the way of writings, in the matter of responsibility for the establishment of the first forest experiment stations, and in general the securing of recognition of the value of research in forestry, are too well known for me to comment upon."

S. T. Dana, president of the Society of American Foresters, writes: " 'To Sam, in memory of our pleasant disagreements. R. Z.' So runs the characteristic inscription on a photograph which I treasure for the many pleasant associations it recalls.

"Nearly twenty years have passed since I first met the original; but time has not served to dim my memory of the friendly helpfulness with which he welcomed an exceptionally green and nervous forest assistant into the august office of Silvics over which he at that time presided.

"Others will do justice to Raphael Zon, the internationally known author, publicist, investigator, and scientist, whose achievements have been fittingly recognized by his election as one of the first Fellows of the Society of American Foresters. I desire to speak rather of 'R.Z.,' the man, whose personality has meant so much and impressed itself so strongly on all with whom he has come in contact. Two of his outstanding characteristics are those to which he himself refers in the inscription quoted above,—his love of an argument and his ability to disagree pleasantly. The first quality is not so rare as the second. There are plenty of people who like to take the other side; but how many do you know who can tell you frankly that you are all wrong, convince you

that he is right, and leave you in a happy frame of mind toward the world in general and himself in particular? A discussion with Zon may be, and usually is, vigorous, but it is never marked by bitterness.

"Zon's wide range of interests, his human sympathy, and his lively imagination are other characteristics that make him a particularly stimulating companion and leader. He may dig deep into such abstruse problems as the relation of light to tree growth, or the influence of forests on run-off, but he is not the type of highbrow scientist to lose himself completely in them. Research is important to him not so much as an end in itself, but as a means of growing more and better forests to meet human needs. His imagination and his sympathy enable him to interpret even studies of hydrogen ion concentration in terms of prosperous wood-using industries and permanent forest communities. And best of all, perhaps, his interests do not stop at forestry. Devoted to his profession, at the same time his conversation is not limited to 'shop' talk. Drama, literature, art, politics, religion, philosophy—how often have I heard him discuss these and other topics with specialists in those fields with the same zest and intelligence that he would show in arguing with one of us what constitutes a forest type.

"Is it any wonder that a man with this personality, and with outstanding scientific attainments, has become almost an institution in the profession? Frank but fair, enthusiastic but not gushing, imaginative but level-headed, sympathetic but not sentimental, and always friendly and sincere, 'R.Z.' has for twenty-five fruitful years been a stimulus and an inspiration to his colleagues. May his influence broaden and his service increase in the next twenty-five."

From the viewpoint of one who was long in authority over Zon it is a pleasure to quote Gifford Pinchot as follows: "One of the happiest of all happenings in human affairs is when a great situation needs a man with scope enough to meet it and the man appears. That is what occurred when, in the very nick of time, Raphael Zon took his place and began his work among the pioneers of the modern forest movement in America.

"When Zon joined the little handful of government foresters in Washington, the fundamental need was not only for such public appreciation of the forest as would result in saving some of it, but also for a firm sound basis of knowledge that would make each advancing step secure. And that was precisely what Zon among all the foresters in America was best fitted to supply.

"What McGee did for the conservation movement, Zon did for the forest movement. Each furnished the scientific foundation upon which a great public movement rested safely during the critical early stages of its growth.

"Zon is first of all a man of science, with the scientific approach to every problem. His encyclopaedic knowledge of facts both in the literature of forestry and the woods is preeminent. But many a man with knowledge has been of little use. Not so with Zon. He follows the truth wherever it may lead him, and supplies to the interpretation of what he finds that scientific method which is one of the great highways along which humanity moves forward to better things.

"During the early days of the modern forest movement in America, Zon's scientific knowledge, scientific acumen, and scientific standards together made up one of the sheet anchors of the Forest Service, and kept us on sound and practical lines in a day when the necessary importance of propaganda made soundness a master element in final success.

"But however great the honor due to a man of science, Zon is far more. In conspicuous contrast with many of his scientific colleagues he has a most practical point of view in the application of scientific knowledge; and that has given him a most conspicuous power to advance the profession to which he belongs and the cause to which he has given his life.

"No man can be the best sort of forester who is a forester only, Forestry regarded as an end in itself, instead of as a means to serve the people, must always fall short of full success. Zon's greatness as a forester rests fully as much upon the statesmanlike breadth of his point of view as it does upon his unmatched technical acquirements. He is not only a forester, but a statesman, and in that combination his greatest usefulness has always lain.

"It is true of Zon's statesmanship, as it is preeminently true of Roosevelt's, that the pith and center of it is the effort to secure equality of opportunity for all men. Zon has seen and used the art and science of forestry as one of the greater means to that great end; and his contribution to the advancement of the forest movement is correspondingly great.

"It follows that Zon is naturally a pioneer, fearless, self-sacrificing, and always willing to travel beyond the beaten paths of routine thought. That is one reason why we honor him as we do.

"Pioneering needs courage, and Zon's courage is as proverbial as his knowledge. He stands up for what he stands for, and leaves no man in doubt of where he stands; hides no convictions; and translates his convictions into acts.

"I have some right to speak of Zon, for we have fought the fight of the forest side by side for many years. I know him not only as a forester, not only as a forest-statesman; but also as guide, philosopher, and friend—a loyal friend and fellow-worker, beside whom I have been proud to work and in whose great and indispensable contribution to American forestry I am both proud and glad to have had a share.

"There is to my knowledge no forester in America, or, for the matter of that, in any other land, who has the combination of qualities and capacities which mark, distinguish, and ennoble my old friend Raphael Zon."

Naturally any such striking personality as Raphael Zon's accumulates stories as it progresses. And there are many "Zon stories" that bring out his humor, insight, and other characteristics, or show what others think of him. Perhaps one of the best is the following: "A noted French scientist was once visiting Gifford Pinchot. Gifford took him through the various government offices (or gave him letters) and thus he met the main heads of the U. S. scientific service. When he was about to leave (after his many interviews) Gifford asked him what he thought of the men. "Very nice," he replied, "I have now seen many of your government men," (all this in French accent) "And I am very much impressed, but among them all, I find only one whom I should call a true savant—Monsieur Zon of the Forest Service."

But the light that shines the farthest shines the brightest nearest home. Sometimes this is overlooked in considering the lives of men who have contributed distinguished service in any line. But not so with Raphael Zon. The closer one gets to know Zon the brighter the light within him shines and the stronger his qualities of generosity, hospitality, humor, kindliness, unselfishness, and friendliness show themselves. One who has known Zon for many years writes of this side of his life: "I believe that it was in his home that I liked Zon the best. There he threw off all of the restraints of the office and became himself. Both he and Mrs. Zon were delightful entertainers, largely, of course, because of their wide knowledge of world events and of their ideas on economic and political subjects. These differed materially in a great many instances from the ideas held by other people which is what made them interesting. Zon's place, as you may know, was a

mecca for all kinds of people, particularly on Sunday afternoons. He liked very much to have people drop in. It was always his custom to serve tea in the Russian fashion at these gatherings. Tea means weak tea flavored with lemon or fruit juices and several cups of it. These gatherings were always most pleasant."

Now it is a pleasure to write nice things about a person and to collect statements from loyal friends as to what they think of him. For instance the following is especially pleasing: "Of course I've been *so* near Zon that I'm a prejudiced witness. He's been a wonderful friend to me; he's the kind that cusses a man to his face and praises him behind his back." (Certainly familiarity has bred nothing but affection and praise here.) And so just the collecting of the data for this article and the writing of it has been an inspiration and a pleasure. But even in writing it one is filled with the realization that Zon is not going to be pleased and flattered by honeyed phrases and adulation—even from his honest admirers and intimate friends. He will be grateful for their kind intentions and appreciation. It will encourage him to go on with what he is doing. But he is not the kind of person who settles back contentedly on his laurels and on the good opinion of others and thereby loses sight of his great goal. For Raphael Zon has a great vision, a vision which comes first in his desires. It is a vision of a happy, prosperous, peaceful people here in the United States, a people amply supplied with forest products of the greatest possible variety, of the highest possible quality and at the lowest possible cost. This is what Zon wants and the really kindest thing that we his co-workers and friends can do for him, is to give him the best opportunity to go on with his work, broadening, enriching and vitalizing it, and increasing the effectiveness of his contribution to forestry, and to mankind through forestry. "For which is better, he that sitteth at meat or he that serveth?" It is not he that sitteth at meat. Zon is in the midst of us as he that serveth.

FREIGHT RATES AND MANAGEMENT OF SECOND-GROWTH FOREST IN PENNSYLVANIA

By E. A. Ziegler
Pennsylvania State Forest School, Mont Alto, Pa.

I—THE PROBLEM

Over 80 per cent of our forest area in Pennsylvania (and the entire northeast part of the United States) is second-growth forest. All foresters know that a young forest must have a dense stocking at first (600 to 2,000 trees per acre) and that this number is reduced by natural death and decay in the unmanaged forest to 90 to 200 trees at the final cutting size. This natural struggle in reduction in numbers greatly retards the maturity of the final cut.

The first great step in intensive forest management after protection from fire is for the forester or forest owner to cut out the least desirable of the young trees at successive intervals and thus (a) hasten the remaining trees to timber size and (b) save a tremendous amount of wood that in the natural forest goes to waste.

The effects of these thinnings are enormous in the total. The forester not only secures a diameter growth in four years in his thinned forest that nature reaches in five years in the unthinned forest thus reducing the rotation age 20 per cent, but he saves in actual wood output an amount of wood from 40 per cent to 70 per cent of the final yield in volume.

To illustrate concretely. The Mont Alto State Forest has the fire evil rather well under control. The present average age is 35 years. The present forest increment (chestnut excluded) is 30 cubic feet per acre per year (including losses in natural thinning which can be saved to a large extent by early and frequent thinnings). Eighteen cubic feet of the 30 or 4,600 cords on the 23,000 acres of forest (90 cubic feet solid per cord) must be left each year toward the final timber cut. *But over 3,000 cords must come out each year as thinnings,* or be a total loss in money: (1) a total loss of $3,000 ($1 per cord) each year to the state school fund in stumpage; (2) a total loss of $12,000 each year to local labor; (3) a total loss of $10,500 each year to the Pennsylvania Railroad in freights, if handled at the rate this material can stand (not over 10c per cwt. or $3.50 per cord). It produces a further loss to the railroad traffic in putting back by 20 years the time when it will

again be able to draw large lumber shipments at a more remunerative rate. As the forest increases in stocking this thinning yield will double in quantity. In saving this thinning material there is in sight then an immediate freight revenue at rates the traffic will bear of 50c per acre each year with the prospects of increasing this to $1 per acre as the forest stand improves. This is thinning only and does not include the lumber freights when final cuttings begin and which will furnish at least $2 per acre per year additional. This latter must be the remunerative source of freight income.

Considering the State's holdings only of 1,100,000 acres, there is here seen an immediate rail revenue of $550,000 to be figured on with the prospects of doubling this from thinnings, and later adding another two million in lumber revenue when the final cuttings come on. The bulk of the state forest holdings are on the threshold of this development, but are held in check by prohibitive freight rates. Large areas of private second-growth forest are in the same predicament. The problem far overbalances the tax problem for Pennsylvania in second-growth forests.

II—THE SOLUTION. FREIGHT RATES

It is desirable to lay down certain facts here: (a) The thinning yields above mentioned are all forest products of low unit value.

Value of Forest Products

CLASS OF PRODUCT	Price at Factory	
	Per Cord	Per Ton
1. Chestnut Extract Wood	$7.50	$4.30
2. 5.5 ft. Lagging, 5-6 tons per M @ $35	....	6.00
3. Fuel Wood (Iron Furnace)	8.00	4.60
4. Paper Wood (requires extensive preparation—peeling)	8.00	4.60
5. Mine Props	18.00	9.00
6. Highway Posts, 40 per cord, 20 per ton, @ 45c each.	18.00	9.00

Compare with rough common lumber worth $30 per M at market or per ton..............................$18
and finished lumber $40 per M, per ton............$24

The freight rate on lumber for a 170 mile haul in Pennsylvania—Mont Alto to Philadelphia is 22½c.

The lowest rate the Pennsylvania Railroad offers for mine lagging and other low grade products is 18½c per cwt. from Mont Alto to

Shamokin district (180 mile zone) or $7.40 per cord (4,000 lbs.) for material bringing $12 to $18 per cord, or the freight is 50 per cent of the delivered value, while for rough lumber for the same haul, it is only 27 per cent and for finished lumber only 20 per cent.

The present freight rates on these low grade products produce no traffic from the Mont Alto forest to the coal mines. Yet over 100 coal cars are hauled back to the mines *empty* from the Mont Alto forest siding each year.

The result of more reasonable rates on traffic is seen in the extract wood business where with freight rates gradually reduced to 6c per cwt. or $1.20 per ton from Mont Alto to Newport (90 miles) this forest produced several hundred cars of traffic each year for the last five years. On account of the prospective closing of this plant on the Pennsylvania Railroad due (they claim) to unfair freights, this business is at an end and there is left to us markets of no size at all.

The Pennsylvania Railroad can afford to make rates on mine wood of not over 10c per cwt. for hauls in the 150 to 200 mile zone, as is shown by:

(1) Their own rate of 6c per cwt. ($1.20 per ton) for extract wood, Mont Alto to Newport—90 miles.

(2) Their own rate of 7½c per cwt. ($1.50 per ton) for fuel wood, Mont Alto to Steelton—70 miles.

(3) Louisville and Nashville Railroad rates for cordwood per ton for
100 mile haul $1.55 per cord, 90c per ton,
140 mile haul $1.69 per cord, 96c per ton.

(4) Southern Railroad
100 mile $1.41½ per cord, 81c per ton,
150 mile $1.69 per cord, 96c per ton.

(5) Nashville and Chattanooga Railroad
80-100 mile $1.41½ per cord, 81c per ton,
120-140 mile $1.69 per cord, 96c per ton.

(Cord rates converted to ton rates at 3,500 lbs. per cord.)

All these roads show less than a 5c rate for a 150 mile haul while the Pennsylvania Railroad demands in the case of mine wood to Scranton region 18½c—180 miles.

To show the excessive freight situation further on the Pennsylvania Railroad on thinnings from second-growth forest the following pulpwood rates are quoted by paper companies:

Freight Rates on Pulpwood

Destination	Railroad	25–50 Miles	50–75 Miles	75–100 Miles	100–150 Miles	150–200 Miles	200–250 Miles
				Rate per 100 lbs.			
Tyrone......	P. R. R.	7.5c	9c	11c	12.5c	14c	....
Austin.......	P. R. R., B. & S.	....	10c	9.5c	13c	....	....
Austin.......	L. V., Erie, B. & S.	....	....	....	....	12.5c	....
Erie.........	P. R. R.	....	9c	11.5c	12c	....	18.5c
Mignon......	P. R. R. & Southern R. R.	....	....	....	....	16c	....
Johnsonburg.	P. R. R.	....	7.7c	....	12c	13c	....
York Haven.	P. R. R.	6.5c	....	....	12c	....	15c
Canton, N. C.	Southern R. R.	....	3.5c	4.5c	5.5c	7c	....
Points.......	L. & N. R. R.	....	....	4c	5c	....	....
Points.......	N. & C. R. R.	....	....	4c	5c	....	....

The southern wood using industries with low local freight rates on wood to the plants of one-half to one-third those of the Pennsylvania wood users, and a relatively lower rate for their products into northern territory are making serious inroads on northern wood using industries, such as mines, pulp mills, and tanning extract plants. This is a serious situation for Pennsylvania forest management as well as for the Pennsylvania coal mines. The Pennsylvania Railroads are bound to suffer with these wood using industries.

It should be further noted that the cost of getting out this thinning material is slightly higher per cord or per ton than when land is cut clear, and forest managers should have every aid from the transportation interests possible. This will make a larger freight net revenue in the long run.

SUMMARY

1. Second-growth forest thinnings have a relatively low value per cord at market, but to save the material and hasten lumber production, it is necessary to market it.

2. Access by the state forests to the mine and pulpwood markets is necessary to market this material.

3. A few rates on the Pennsylvania Railroad and all rates on southern and central United States railroads show that rates of 6c to 10c per cwt. for local hauls of 50 to 200 miles are not unreasonably low and will permit marketing large quantities of this thinning cordwood, pulpwood, lagging, props, sprags, etc., and at the same time lessen the import of wood by our mines and pulp mills from other states at joint rates that produce no greater revenue to the railroads of Pennsylvania.

ADJUSTMENT OF THE VOLUME REMOVED IN SELECTION FELLING*

By W. W. Ashe

U. S. Forest Service

As a rule plans designed to place woodland upon a basis of permanent yield or having for their object conservative felling with a view to a recut, contain provisions for leaving a certain proportion of the smaller trees. This is sometimes the only provision respecting the class of timber which will not be cut. Even when there is no mention of a fixed diameter limit for felling, if any logical scheme for selective felling is analyzed, it is apt to show that practically all trees of the smallest merchantable diameters are left and a progressively decreasing proportion of those of larger size. Some of the smaller trees may be removed in thinnings; some larger trees are left for seed trees or for making accelerated growth. If the average number of trees per

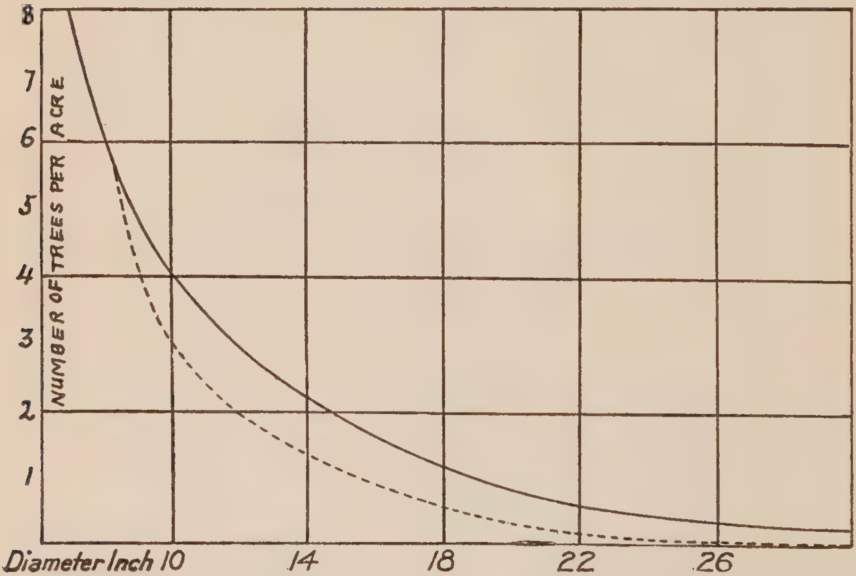

Figure 1

Number of trees of different diameters per acre in normal stand and number of trees left after felling designed to secure a sustained yield.
—— Diameter classes in normal stand.
.... Diameter classes, 9 inches and over, after felling for sustained yield.

*Presented at the Annual Meeting of the Society of American Foresters, Madison, Wisconsin, Dec. 16-17, 1925.

acre of different diameters in the stand and the number of trees of different diameters which are selected for removal are platted the results will probably be much as indicated in Figure 1. In marking in this manner the main consideration usually is to leave trees which will serve as a basis for a second cut at an early period. The owner of the property, whether sawmill operator, timberland owner, or farmer, is entitled to know:

1. Whether leaving these trees will curtail his present profits or will add to them.
2. In case there is a curtailment of present profits the amount of it.
3. In how far the loss of interest on these unrealized present profits is offset by the profits expected as a result of the second cut.

These are matters of sound business.

There are four sets of factors which enter into the first of these problems:

1. The cost of manufacturing into lumber timber of different sizes.
2. The relation of the curtailment in cut to overhead costs.
3. The relation of the elimination of the product of trees of certain diameters from the mill output (1) to the proportion of the different grades of lumber which are produced from the remaining timber and (2) to the average selling price of the output of lumber.
4. The stumpage values of trees of different diameters[1].

The rapid increase in the cost of certain processes in the logging of trees and in the manufacture of lumber with decrease in the size of timber has already been pointed out.[2]

Attention has likewise been called[3] to the fact that in case the smaller trees in the stand are not cut the lumber output of the mill, being the product of the remaining trees which are the larger ones, contains fewer boards of narrow widths and in the case of most species contains a smaller proportion of lower grades and consequently has a higher average selling price.

[1] The method of computing the stumpage values of trees of different diameters will be presented in a subsequent paper.

[2] Forest Quarterly, 14:441 seq. 1916.

[3] Proceedings Southern Logging Congress, Oct., 1914. Also in Lbr. Trade Journal, New Orleans, 9:66:31. Nov. 1, 1914. In this connection see Reducing the Cut of the Lower Grades of Hardwood Lumber, American Lumberman, March 29, 1924, and Economic Waste in Cutting Small Timber, Southern Lumberman, pp. 184-187, December 20, 1924.

It now seems desirable to follow up these papers by showing their application to specific classes of operations in connection with developing plans for conservative felling looking toward recutting or continuous operation.[4]

Leaving the smaller trees in a stand uncut (a) cheapens certain processes in the production of lumber from the remaining trees in the stand. It may also (b) increase the selling price of the lumber produced. This might result in (c) an increased profit per thousand board feet from the remaining timber which is cut, but accompanying the curtailment in product per acre which results from leaving the smaller trees uncut, there is (d) an increase in the cost of various elements of overhead.

In a case where all lumber is sold at the same unit price there is a felling diameter at which the difference between the logging costs (a), and overhead costs (d), are at a minimum and where the profits per thousand feet in the operation are at a maximum. This size can be called the diameter of maximum profits. In case additional small trees are removed the increase in the piece or item costs is more rapid than the decline in the cost of the overhead and the profits per thousand feet of output of lumber are reduced. In case the diameter for felling is raised and a smaller proportion of the larger trees is removed the overhead costs per thousand feet of output increases more rapidly than the piece or item costs per thousand board feet of output declines and there follows a decrease in the profits per thousand board feet of mill cut. The relation of these two elements of cost to each other is shown graphically in Figure 2. So long as the increase of logging costs, (a), is in excess of the decrease of overhead costs, (d), small timber is being cut which it would be economy to leave. So long as overhead costs, (d), are increasing in excess of the decrease in logging costs, (a), not enough timber is being cut to reduce the overhead costs to the point of greatest economy.

It is not intended to imply that in some cases all timber can not be removed at a profit but there is a diameter at which the greatest profit per thousand board feet is made on the timber which is cut in an operation having considerable overhead. In many operations

---

[4] In this connection the statement of Mr. P. C. Gammill, Manager of the Edgar Lumber Company of Wesson, Ark., is interesting in explaining the manner in which he employed tables of logging costs and values of timber prepared by the writer in fixing upon an economical diameter for operating this mill which had been upon an unprofitable basis. See Proceedings 15th Annual Meeting Southern Logging Association, page 25; also New Orleans Lumber Trade Journal, Oct. 1, 1925; and Lumber Manufacturer and Dealer, Oct., 1925.

much of the smaller timber is of marginal value being operated at a high cost and selling at a low cost, and this is particularly true in the case of timber in newly opened or in less accessible regions and the low grade species in mixed stands in rough regions especially where the forest complex is of many types.[5]

The stages in the production of lumber, the cost of which is influenced by the diameter of the tree, are the piece costs or labor expended upon the tree itself or upon parts of the tree, logs or lumber, in distinction to labor or the cost of equipment which is expended upon the stand as a whole or upon definite groups of trees in that stand. The logging and milling labor costs (referred to merely as piece or item costs) are the labor costs in felling, in skidding (excluding road construction), in loading, in hauling, (excluding railroad equipment, construction, maintenance and plant amortization but not operation), and handling and sawing at mill (but not overhead of mill construction), together with insurance, taxes and carrying charges on lumber and selling commission. So long as there is a surplus over and above the piece or item costs this surplus will go towards reducing the cost of road construction, or railroad construction (transportation overhead), mill construction (mill overhead), and general office overhead which should include general taxes and general carrying charges of the timber as well as general office expenses other than selling, lumber, insurance, salaries, etc. The small tree must repay every item of expense[6] except road construction, railroad construction, camp construction, mill construction and general office overhead. In case the small tree does not make a contribution to these the expense of meeting them must be borne entirely by the other timber.

There are several general sets of conditions which influence the weight to be attached to the factors which have been enumerated. One is the case of a mill cutting low grade timber, all of the lumber from which is sold at the same prices, such as small framing, boxboards, or like stock. The only factors in such a case are the relative cost of logging and milling trees of different size and the relation of the amount of the cut to the overhead. Such a mill may be a permanent operation with logging done by a railroad and having a heavy overhead, or it may be a portable outfit with lower overhead. In the case of a

---

[5] Forest Types of the Appalachians. Journ. Mitchell Sci. Soc. 37:183, 1922.

[6] Proceedings Appalachian Logging Congress, 1924, page 10, and Lumber Manufacturer and Dealer, pp. 27 and 82, Oct. 31, 1924.

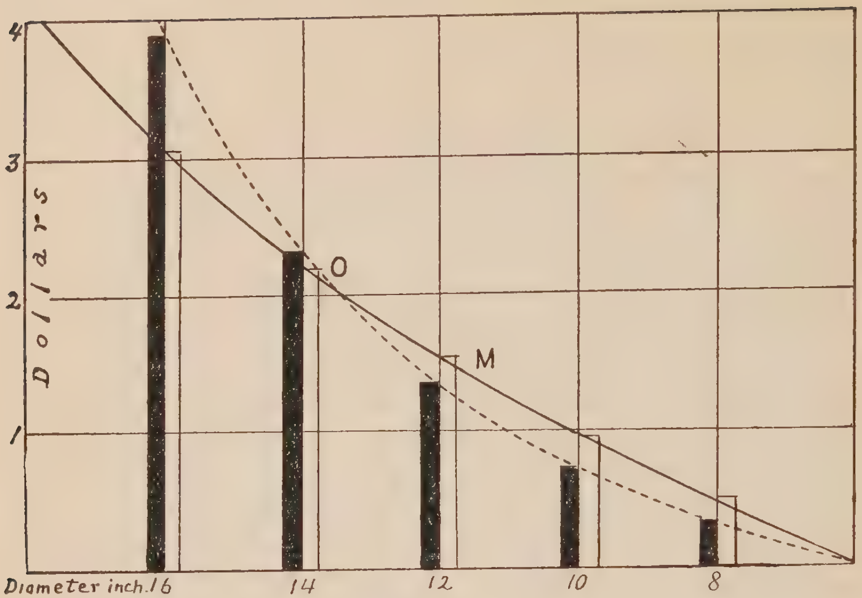

Figure 2

Effect of not cutting trees of and below a given diameter (1) in increasing gross profits and (2) in increasing overhead costs. Cases where lumber is sold at a uniform price. At each diameter is shown the effect of not cutting timber of and below this diameter upon the cost of operating remaining timber.
□ Increased gross profits.
■ Increased overhead costs.
M Diameter of maximum increase in net profits.
O Diameter at which increased overhead costs become equal to increased gross profits.

mill having all of its logs delivered some of these factors do not affect the operation of the mill but affect only the logger. This is the case with farmers who log their own timber and sell the logs or with logging companies or with loggers who operate under contract. The problem in these cases is comparatively simple. Overheads still exist but they are usually reduced to a minimum. In the case of a landowner or farmer or another person logging his own timber the average cost of logging is one factor; the value of the timber is another (realization value, that is, stumpage value plus profits); and the realization value must be kept distinct from the logging costs. In case the timber so logged (such timber may be sold just as it is cut) is sold on the basis of difference in grades of logs (that is in effect different in size of trees) another element enters. But the problem

is still comparatively simple, the factors being restricted to piece-labor costs and limited and well defined overheads. Too often, however, the farmer on account of the fact that his time at certain seasons is assumed to have no value, and that any use of his teams which will even in part offset their feed is held as profit, is lured into an operation which is wasteful of timber as well as of labor resources.

In case lumber is sold on the basis of grades or size and there is difference in the proportion of grades or sizes cut from trees of different diameters, this complicates the problems. The increased value of the lumber cut from larger trees after the smaller trees are eliminated is to be added to the decrease in the piece-work logging costs as an increased margin of profit and from the sum of these two is to be deducted the increase in the overhead costs. This is graphically shown in Figure 3. The selling price of the lumber would be a curve in place of being a horizontal line as in Figure 2. The diameter of greatest profit is at the point M, where the curve which represents the resultant savings effected in logging plus the increased value of product is farthest from the curve of increase in overhead costs.

As a prerequisite to the analysis of the situation with reference to any operation it is necessary to ascertain:

1. The number of trees of different diameters in the stand.
2. The per cent. of mill cut contributed by each diameter.
3. The grades of lumber cut from each species.
4. The change in the selling price of the lumber output of the mill in case all or any proportion of the trees of any diameter are not cut.
5. The overheads per M. feet B.M.
6. The increase in the overheads in case certain classes of trees are not cut.
7. The decrease or change in the piece-labor costs of logging or milling as a result of leaving uncut any class of timber.
8. In the case of mixed stands data must be available for each species.

The principles involved are equally applicable to a western fir, white pine or yellow pine operation, to an operation in hardwoods or pine in the Lake States, to hardwood or mixed stands in New England or in the Appalachians, to longleaf pine, to heavy virgin timber as well as to second growth stands.

The accompanying tables show the methods of presenting results. These tables are based upon a case where logging was done by contract and at a fixed rate, the only variable factors being sawing, stacking, transportation, handling, loading, grading, and office salaries.

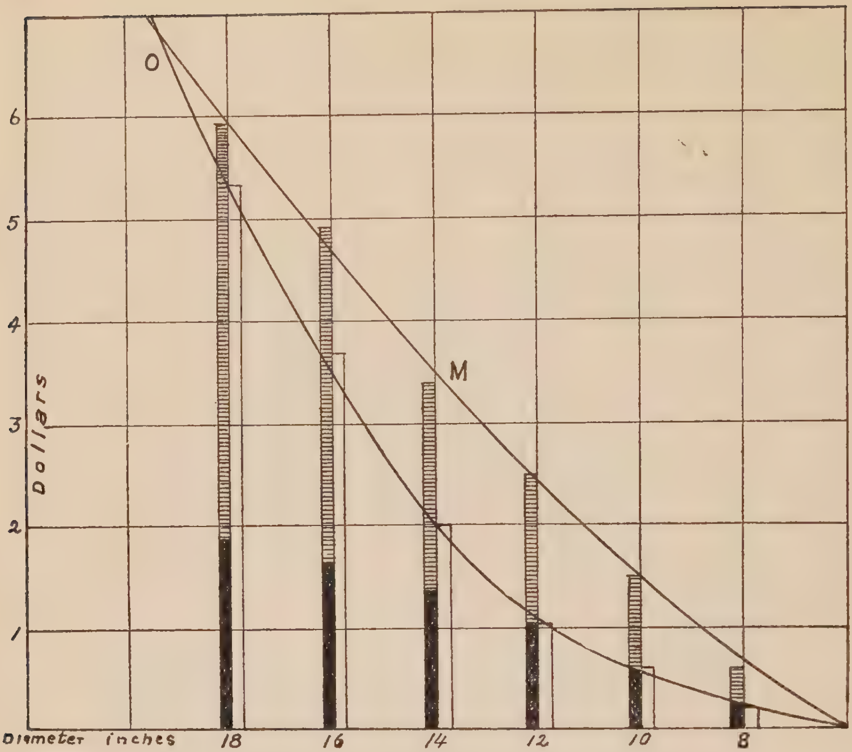

Figure 3

Effect of not cutting trees of and below a given diameter (1) in increasing gross profits by decreasing piece-costs and by increasing selling price of lumber; (2) in increasing overhead costs. Cases where lumber is sold upon a graded basis.

■ Decrease in logging costs per M feet b. m. } increase in gross profits.
▤ Increase in selling price of lumber }
□ Increase in overhead costs per M feet b. m. of lumber output.
M Diameter of maximum increase in net profits.
O Diameter at which increased overhead costs become equal to increased gross profits.

The stand per acre is 4,500 feet mill cut. The median tree (Table 1) of the stand has a diameter of 19 inches, 50 per cent. of stand being above, and 50 per cent below this diameter. The average tree (the total volume per acre divided by the number of trees per acre) has a volume of 191 feet mill cut which corresponds to a diameter of 14.2 inches.[7]

[7] The volumes used are from Bulletin 24, N. C. Geological Survey, p. 126 and all other figures are based upon data secured at a sawmill operation.

Table No. 1

NUMBER OF TREES IN EACH DIAMETER CLASS; VOLUME IN BOARD FEET OF AVERAGE TREE OF EACH DIAMETER CLASS; VOLUME IN BOARD FEET OF EACH DIAMETER CLASS; AND PER CENT. OF STAND IN EACH DIAMETER CLASS

Diameter of average tree in group. Inches	Number of trees per acre	Volume of average tree. Board feet	Volume of group. Board feet	Per cent. of stand in each group
7.7	6.6+	27	178	4
10	4	58	232	5
12	2.4+	113	271	6
14	2.5	184	460	10
16	2.2	264	581	13
18	1.1	358	394	9
	18.9+		2,116	47
20.3	5		2,364	53
	23		4,500	100

The median tree on which a selling price of $31.80 per thousand feet at Norfolk, Va., is based is one of 19 inches in diameter. Such a tree saws out about 400 board feet and has 3½ logs or about 9 logs to the thousand feet.

Table 2 gives the value of lumber cut from trees of different diameters and the increase in the selling price of lumber if smaller diameters are not cut. Table 3 shows the decrease in logging costs if smaller trees are not cut. Table 4 shows the increase in overhead if smaller trees are not cut. Table 5 is based upon Tables 2, 3, and 4.

Not cutting the 8-inch trees (Table 5) results in a net increase of 80 cents profit per thousand feet of lumber sold. Not cutting those of 10 inches and less increases profits $1.39 per thousand feet. Not cutting those of 12 inches and less increases profits $1.78 per thousand feet. Not cutting those 14 inches and less results in a profit of $1.84 per thousand feet for the timber which is cut. Not cutting those of 16 inches and less results in a decrease of profits to $1.50 per thousand feet for the remaining timber. The diameter of maximum profits consequently is between 14 and 16 inches breast high and is probably nearer 14 inches than 15, that is, it might be said that not cutting trees below 14 inches in diameter will result in the greatest profits per thousand feet for the output of the mill.[8]

[8] "Cutting to Increase the Margin of Profit," American Lumberman, Dec. 19, 1925; also Lumber World Review, Dec., 1925; "Cutting Shortleaf Pine to Meet Western Competition," N. C. Pine Association, 1925.

The diameter of maximum profit is not necessarily the diameter which should be advocated as the desirable one to establish in plans for cutting for permanent operation. In case clean cutting would give a profit of $2 per thousand feet and this profit was considered satisfactory and the diameter of maximum profit 13½ inches gives a profit of $3.38, the diameter could be further raised until the profit had again declined to $2 which was considered a satisfactory margin (O, Fig. 3).

It is not necessary that all trees in a diameter class be cut. The procedure is easily modified so as to adapt it to the removal of any

TABLE NO. 2

COMPARATIVE VALUE OF SHORTLEAF PINE LUMBER SAWED FROM TREES OF DIFFERENT DIAMETERS AND INCREASE IN SELLING PRICE IF TREES OF AND BELOW A GIVEN DIAMETER ARE NOT CUT

Average selling price of all lumber f. o. b. Norfolk, Va........$31.80

Diameter classes. Inches	Price of lumber cut from trees of each diameter Norfolk base	Per cent. of cut from trees of different diameters	Selling price of lumber from larger trees if small sizes are not cut	Gain in selling price
8 and under	$21.70	4	$32.22	$ .42
10	23.15	5	32.72	.92
12	25.10	6	33.26	1.46
14	27.35	10	34.04	2.24
16	29.00	13	35.10	3.30
18	30.50	9	35.88	4.08
20 and over	35.88	53		

TABLE NO. 3

COST PER 1,000 FEET OF LUMBER OF PIECE WORK IF TREES OF AND BELOW A GIVEN DIAMETER ARE NOT CUT. IF ALL TREES ARE CUT, THE PIECE OR ITEM COSTS ARE $7.38 PER 1,000 FEET

Diameter classes. Inches	Piece costs per 1,000 feet b.m. for timber of and above a given diameter	Decrease in piece costs
8	$7.38	——
10	6.80	$ .58
12	6.32	1.06
14	6.00	1.38
16	5.78	1.60
18	5.50	1.88
20	5.26	2.12

TABLE No. 4

AMOUNT OF OVERHEAD COSTS IF TREES OF AND BELOW A GIVEN DIAMETER ARE NOT CUT; INCREASE IN OVERHEADS AND NET INCREASE IN THE SELLING PRICE OF LUMBER

Average overhead if all trees are cut ....$6.00 per 1,000 ft.

Diameter classes.	Per cent. of cut	Overhead per M ft. if trees of and below a given diameter are not cut	Increase in overhead
Inches			
8	4	$6.20	$ .20
10	5	6.59	.59
12	6	7.06	1.06
14	10	8.00	2.00
16	13	9.68	3.68
18	9	11.32	5.32

TABLE No. 5

EFFECT UPON GROSS PROFITS, UPON OVERHEAD COSTS AND UPON NET PROFITS PER 1,000 BOARD FEET OF LUMBER IF TREES OF AND BELOW A GIVEN DIAMETER ARE NOT CUT

If trees of and below diameter are not cut	Decrease in piece logging costs	Increase in selling price of lumber	Gross increase in profits	Increase in overhead	Net increase in profits per 1,000 feet
Inches	a	b	c=a+b	d	e=c—d
8	$ .58	$ .42	$1.00	$ .20	$ .80
10	1.06	.92	1.98	.59	1.39
12	1.38	1.46	2.84	1.06	1.78
14	1.60	2.24	3.84	2.00	1.84
16	1.88	3.30	5.18	3.68	1.50
18	2.12	4.08	6.20	5.32	.88

proportion of the trees of a diameter class and in fact its highest merits will come from its employment in connection with selection felling or when a number of larger trees are left for value increment to furnish high grade timber in the second cut. As an example, in case one-half of the trees in each of the classes, 12 inches and below, are not cut, the others being taken out in thinnings and one-half of the trees in the 16-inch class and one-third of those in the 18-inch class are not cut the effect upon profits would be shown as follows:

Seventeen per cent. of volume would not be cut, and the cost of the overhead would increase from $6.00 to $7.23 per 1,000 feet, being an increase of $1.23 in the cost of production. The selling price of the lumber would increase from $31.80 to $32.81 or a net increase of $1.01 per 1,000 feet b.m.

EXAMPLE OF PARTIAL CUTTING ON VALUE OF CUT

Diameter class. Inches	Price of lumber from column 2 Table 2	Per cent. of stand not cut	Value of per cent. of timber not cut
8	$21.70	2	$43.40
10	23.15	2.5	57.88
12	25.10	3	75.30
16	29.00	6.5	188.50
18	30.50	3	91.50
		17	$456.58

Average selling price of all trees cut (Table 2) $31.80 per 1,000 feet. Average selling price of remaining 83 per cent is $32.81 per thousand feet if the 17 per cent., having a total value of $456.58, is not cut. Thus there is a gain of $1.01 per 1,000 feet.

In case one-half of the trees in the classes 12 inches and smaller are not cut the piece costs which were $7.38 per 1,000 feet if all timber were cut decrease $ .53. That is $6.32 deducted from $7.38 leaves $1.06 and $1.06 divided by 2 gives $ .53. In case one-half of the trees in the 16-inch class are not cut the piece costs decrease to the amount of one-half of the difference between $5.78 and $5.50 (Table 2, column 2), which is $ .14. Similarly if one-third of the 18-inch class is not cut there is a decrease in logging labor costs amounting to one-third of the difference between $5.26 and $5.50, amounting to $ .08. There is thus a total decrease of $ .53 plus $ .14 plus $ .08, amounting to $ .75, in piece-costs.

The net result is an increase of $1.23 in overhead costs. To a gain of $1.01 per 1,000 feet in the selling price of lumber is to be added $ .75 decrease in piece costs, making an increase of $1.76 in gross profits and after deducting the increase in overhead costs a net gain in profits of $ .53 per 1,000 board feet.

The information which will be secured by an engineer from such an analysis of an operation is a logical prerequisite to any presentation of plans for cutting for a permanent yield. The landowner, whether sawmill operator or farmer, should know first how his present profits may be affected by a modification in this cutting regimen; second, as to estimated yield and expected value of the second cut. These are basic engineering problems involved in planning to place lands upon a continuous yield.

It enables the engineer to show graphically, by a series of easily understood charts, the effect of leaving any group of trees or any

given proportion of any group of trees upon logging costs; upon the selling price of lumber; upon the overhead costs; and consequently upon the profits of the operation.

Each operation, nearly every tract of woods in fact, has its individual problems due to different conditions and requires separate analysis to weigh the basic factors. The methods of considering or handling these problems can be standardized but it is believed that any attempt to generalize the results with a view to adapting them to regions or to groups of mills probably will issue in failure to furnish positive information as to whether the plan entails profit or loss to the landowner and how much of either.

STUDIES OF WHITE PINE BLISTER RUST IN THE WEST*

By H. G. Lachmund
Assistant Pathologist

White pine blister rust has an interesting history. This rust is a disease of white pines and of currants and gooseberries. The causal organism is the rust fungus *Cronartium ribicola.* All tested five-needle "white" pines and all currants and gooseberries are susceptible to it. On the pines the fungus lives as a perennial; on the currants and gooseberries, as an annual. Infection in both cases occurs through the *stomata* or breathing pores in the leaves. The first symptoms of the disease on *Ribes,* that is currants and gooseberries as they are collectively termed, generally consist of small, yellowish or orange-colored spots in the leaf tissue which appear on the under surfaces about ten to fifteen days after infection and often show through on the upper surfaces. From the infected spots on the under surfaces, early summer-stage spores are first produced which serve to spread the disease to surrounding leaves and to neighboring bushes, but which can not infect pines. Later in the season, from these spots, and massed together in short, brownish, hair-like columns, late summer-stage spores are produced which germinate in the presence of moisture to form four small *sporidia* each. These *sporidia* can infect only the pines.

On the pines the rust grows through the needle into the bark, becoming apparent in the latter, generally in the second year following infection, as a yellowish discoloration accompanied by slight swelling. This discoloration and swelling spreads until the branch is girdled, spread being usually two or three times more rapid longitudinally than around the branch. The canker grows in length from about two to eight or nine inches a year and in width from about one to three or four inches. One to three or four years following girdling, the branch dies beyond the point of the canker, although the fungus may continue to spread down the branch if it is sufficiently close to the bole or to living side branches.

Usually in the year following its appearance the canker produces the relatively large, stout-walled spores which infect the currants and gooseberries. These spores form on fruiting bases within the tissues of the bark and are produced in masses surrounded at first by thin, whitish membranes or *peridia* which push through the outer bark as

* Paper presented before the California Section of the Society of American Foresters, at San Francisco, California, January 15, 1926.

whitish or yellowish blisters. It is from these that the rust gets its name. The fruiting blisters are produced generally in the early spring and soon after pushing through the bark break open and liberate the spores by the millions. These spores which in mass appear as an orange-colored dust or powder are easily caught and carried about in all directions by the winds. They can not infect the pines but will infect the currants and gooseberries.

Since these spores are loose and easily disseminated and since they are relatively thick-walled and of great longevity, the spread of the rust from pines to currants is very extensive, while because of the great fragility of the pine-infecting spores which are produced on the currants and gooseberries, the spread from these hosts[2] to the pines is narrow and limited and generally rarely of significance at distances greater than 900 feet.[3]

The rust is a native of Asia. On its native host, *Pinus cembra* (the stone pine), it was doing little damage, but in reforesting in Europe and Russia during the middle of the 19th century *Pinus strobus* (eastern white pine) was used extensively. On this close relative of the stone pine the rust found a new and exceedingly congenial host and, starting from the Baltic provinces of Russia, it has spread through Europe and into the British Isles to such an extent that the use of white pines in reforesting there was largely given up by 1910. Meanwhile, planting of eastern white pine in the eastern United States and Canada had increased to the point where from 1907 to 1911 our nurseries could not supply the demand and European nurseries were called upon to supply the deficiency. With the seedling stock brought in during these years the rust became widely distributed through much of the native range of this tree in the East.

Until 1921 it was thought that the West with its highly valuable stands of western white and sugar pines (*Pinus monticola* and *P. lambertiana,* respectively) was free from the disease. The results of earlier scouting for the rust had been negative and rigid quarantines had been developed and applied to keep it out. In the fall of that year, however, it was found at several points in southwestern British Columbia and northwestern Washington. This discovery immediately set into action all available forces to meet the situation. A conference

[2] The cultivated black currant *Ribes nigrum* must be considered an exception. Experience in the eastern United States and Europe indicates that this limit can not be depended upon with this species.

[3] The foregoing description of the rust summarizes the published results of studies by numerous investigators in eastern America and in Europe together with western observations.

of all parties concerned was called at Portland, Oregon, in December, 1921. This conference recommended federal appropriation of $150,-000 to be used in 1922 on the following emergency projects in the West:

1. Scouting for the disease.
2. Quarantine enforcement in the West.
3. Studying western factors in spreading the disease (susceptibility of host plants).
4. Survey to determine natural barriers.
5. Experimental eradication and control.

Western white pine extends from the upper elevations in the sugar pine regions of the Sierra Nevada in California northward, mainly along the Cascade Mountains, into British Columbia. The Coast Belt of white pine extends through western Washington and the coastal section of British Columbia and on Vancouver Island to about 150 miles north of the boundary. The interior belt centers in the Inland Empire region of northern Idaho and adjacent Washington and Montana and stretches northward into British Columbia for about two hundred miles. *Pinus albicaulis,* an alpine white pine of negligible commercial value, follows the higher elevations in both ranges and extends about 100 miles farther north in both.

The main commercial range of western white pine is confined to the Inland Empire region. Here the lumber industry is largely dependent upon this tree for its existence. Throughout these ranges wild currants and gooseberries are wide-spread. Cultivated species are of relatively little importance south of the International Boundary, since the species favored are resistant to the rust and the extremely susceptible black currants are but sparsely grown and are rapidly being uprooted voluntarily by their owners. In British Columbia, however, this species is very extensively grown. It is, in fact, generally considered of greater economic importance than white pine in this province.

By the end of 1922 the range of the rust on white pine had been carefully determined. It was found to include almost the entire Coastal pine region of British Columbia and three points in the interior pine region of this province. South of the line the rust was found on pines at only two points, Blaine and Mt. Vernon, both in northwestern Washington. (At both places infection was of relatively recent origin.)

Coincident with scouting, the Office of Forest Pathology inaugurated the following studies:

1. Early history of the rust in the West.
2. Method of spread and influence of weather conditions.
3. Existence of or possibility of creating a barrier to the spread of the rust southward.
4. Reaction of various *Ribes* to infection and capacity to produce spores capable of infecting the pines.
5. Damage to western white pine.
6. Distance of spread from *Ribes* to western white pines.

EARLY HISTORY OF THE RUST

In reconstructing the early history of the rust it has been necessary to develop a method of determining as nearly as possible the years in which infection took place. Systematic study showed the majority of the cankers resulting from infection in a given year to be concentrated upon the growth of the season preceding that of infection with most of the remainder on the growth still one year older. This made it possible to determine with fair accuracy the years in which the pines were infected at each study locality. Studies at various infection centers all over the range of the rust developed strong evidence that the rust had become established at all of the oldest ones, (scattered from North Vancouver northwest 130 miles, north 110 miles, and east about 70 miles) in 1913. This was supported by examination of weather records which showed that this year was outstandingly a favorable one for the development of the rust.

At the same time infection evidently of 1910 origin was discovered in a planting of eastern white pines at Point Grey, near Vancouver, B. C., made with seedlings shipped from the nurseries of Pierre Sebire and Son, Ussy, France, a locality in which the disease is known to have been present then. All evidence it has been possible to collect indicates that this was the original introduction. In the interior the rust evidently became established in 1917 or 1918. This was likewise the case in northwestern Washington.

From a single point in 1910, then, the range of the rust on pines widened in a single year, 1913, to cover a great area hundreds of square miles in extent. Again in 1917 or 1918 infection was carried across the interior dry belt, an area devoid of white pines, to become established on pines at three points in the interior pine region, Canoe, Revelstoke, and Beaton. In the coastal region it spread north to pines at the head of Butte Inlet, 150 miles north of Vancouver, and, from indications from recent scouting, evidently to several points in the

Puget Sound region of northwestern Washington up to 100 miles to the south.

METHOD OF SPREAD

This wide distribution of infection following its introduction in 1910 could be explained adequately in only one way. It could not have taken place from pine to pine. Nor could the disease very well have been distributed artificially by the introduction of either host, for in the coastal region the infection centers are located mainly in associations of native white pines and *Ribes* away from any cultivated plants. It might have spread from currant to currant, overwintering on them as it went, but spread from currant to currant is almost invariably very limited. That the wide and rapid spread of the rust could be explained on the basis of wide dissemination of pine-infecting spores from currants and gooseberries to pines was out of the question. Pine infection is invariably confined within the near vicinity of *Ribes*. The only remaining alternative is that wide spread occurred by dissemination of the spores produced on the pines and infection of *Ribes* up to distances of over a hundred miles. That such a distribution of the rust could be accomplished by this means was an idea generally not accepted nor even entertained at this time.

Since 1922 circumstantial evidence has accumulated which discards all other theories. This evidence is drawn chiefly from the data accumulated in the study of the yearly distribution of the rust on the currants and gooseberries. Analyzing this data with respect to the method of spread, it is obvious that the theory of overwintering and spread by *urediniospores* (spores produced by the rust on *Ribes* which serve locally to intensify and spread the rust on these hosts but will not infect pines) can not be accepted. The presence of the rust 1923, its absence 1924, and reappearance 1925 at various places through the dry belt, its reappearance after an absence of two years on the Ilwaco Peninsula and at other places in western Washington, its distribution in Oregon and the Cariboo District all argue emphatically against this. Furthermore, spread by *urediniospores* can only be very limited in general when these spores fail during the course of an entire season to spread the rust through even a small planting of the extremely susceptible cultivated black currant as they failed during 1925 at many places where infection was found in the dry belt and Cariboo Districts.

The presence and character of infection at these widely scattered places indicates quite definitely that infection became established there by spores from the pines (*aeciospores*) and that the whole country

must have been showered by these spores. The same explanation must account for the long spread of the disease to *Ribes* in western Washington and Oregon and in the coastal region of British Columbia.

Birds could have participated but slightly in this wide dissemination. The great majority of the *aeciospores* are generally matured and liberated in the latter half of April and the first half of May. At this time the birds are following rather definite lanes of flight from south to north, one set in the interior and one in the coastal region. In the interior there are no infected pines to the south. There are likewise none south in Oregon. The character of infection at the various widely scattered plantings in the Cariboo District and the dry belt also contradicts any such possibility. As stated above, infection in most places focused in a definite point on one or two leaves. There was no general distribution of original infection points over a planting such as might be expected from a flock of spore-covered birds. Nor, for the same reason, and because infection was generally more or less of even age in these plantings, could birds have played much part in distributing the rust locally in these sections following the production of *urediniospores*. The same applies to man and animals. The only acceptable theory is that of distribution by wind-borne *aeciospores*. Unlike the *urediniospores,* which stick together, these spores are produced loosely and are easily caught and carried by the winds. They retain well their capacity to cause infection and it is easily conceivable that under favorable circumstances they might ride for great distances and still remain alive and vigorous.

The evidence presented by the western distribution of the rust during the years studied and before indicates the usual limits of spread from pine to currant here to have been about 150 miles. Due to the dissipation of the spores with increasing distance from their source and to losses in their viability or capacity to cause infection with increasing age and exposure to unfavorable conditions, it is obvious that in the outlying sections of the range of spore dispersal only a small percentage of the *Ribes* may be exposed to infection. It is to be expected, therefore, in these sections that even in the most favorable seasons the points at which *Ribes* infection may become initiated will be scattered.

The chance that infection will be spread to the pines at such places depends entirely upon variable conditions. These include the proximity of the pines, the susceptibility of the diseased *Ribes,* the number of spores produced which are capable of infecting the pines,

and weather conditions at the time the spores are produced. A favorable period of precipitation and high humidity is essential. But even under the most advantageous of circumstances only a very slight fraction of these fragile pine-infecting spores can ever live. Great numbers of them are produced during nights on which there are heavy dews, and in the warmth and brightness of the following day they lose all capacity to infect and soon die. Again, the vast majority of them must fall on sterile ground. In any event, the history of the spread of the rust in the West shows quite definitely that most of these spot infections of *Ribes,* even when close to pines, may be expected to run the course of their season's development and die out without establishing the rust on the pines. On the other hand, any wide distribution of the rust to *Ribes,* such as that of the past season, covering extensive white pine-bearing regions, is almost sure under any circumstances to result in the establishment of a few new outlying pine-infection centers.

Once established on the pines, nothing short of the most energetic control measures can prevent the establishment of numerous new centers and the multiplication of the rust in the general vicinity within a few years. That is undoubtedly what will happen very shortly in the country surrounding Nelson, thirty miles north of the Idaho line, at which place infection evidently became established on pines as a result of the rust's spread to cultivated black currants here about 1920 and again in 1923. It should be noted here that the cultivated black currant has played an extremely important part in the wide distribution of the rust in British Columbia. It has become heavily infected where infection has been slight on other species and its importance increases in the dryer climates where infection on other species is greatly reduced or inhibited by unfavorable weather conditions. This is particularly evident in the wide spread of the rust over the Dry Belt and Cariboo Districts of Interior British Columbia. Over this extensive region, miles from infected white pine, this species has been the only one found infected.

The southern extension of *Ribes* infection has varied with the season. In 1922 the southernmost point at which it was found was Ilwaco in the extreme southwestern corner of Washington. While in 1923 and 1924 the rust on *Ribes* was found south only to about the latitude of the southern end of Puget Sound, it appeared last year not only at Ilwaco but at a number of other places in southwestern Washington and at three points in northwestern Oregon, the farthest south

being on the coast 100 miles south of the Columbia River at its mouth. This illustrates the rust's capacity for southward spread.

That the rust will invade the range of sugar pine may be considered a certainty. When and by what route this may occur is entirely open to conjecture. At present the southern limits of known pine infection are in west central Washington. This does not mean, however, that such infection may not exist at places for some distance south of these limits, for it is very difficult to find infection on the pines until it has developed in a locality for a number of years.

With respect to the influence of climatic conditions within the range of sugar pine, it seems reasonable to expect, in view of the relatively limited intensification of the disease during dry seasons in its present range that the characteristically dryer summer and fall conditions of the sugar pine regions will be less favorable for the disease on *Ribes* and its transmission to the pines than is the case farther north. This would no doubt retard the general establishment of the rust through the range of the pines here. But certainly there are no grounds for considering it any guarantee against heavy damage to California white and sugar pine-producing values, once the rust is established in this region.

BARRIERS TO THE SPREAD OF THE RUST

With the knowledge of the great distance of spread from pines to *Ribes* it became evident that no barrier to the southward advance of the disease existed, and all hope of creating such a barrier had to be given up.

RELATIVE INFECTION OF RIBES

Considering the *Ribes* in their reaction to the rust, the most urgent phase of this study concerns the species most important numerically as associates of the main bodies of western white pine in the Inland Empire region. These species, the prickly currant (*Ribes lacustre*), the sticky currant (*R. viscosissimum*), the white stemmed gooseberry (*Grossularia inermis*), and the wild black currant (*R. petiolare*), are being tested by inoculation within the range of the rust in the Dry Belt of British Columbia, some miles from Kelowna. This place was one of the localities in which cultivated black currants were heavily infected in 1923 and it is interesting to note here that during the present season we found infection of 1923 origin on a planted white pine near a black currant patch in this town.

The present test constitutes by far the most comprehensive syste-

matic study of its kind ever attempted for white pine blister rust. It is giving good results. It will take some three months or more to compute and organize the data collected this year and last; so I can not give you figures at present. I can, however, state that the results this year will, in general, tend to substantiate those of last year which indicate that, comparing equal units of leaf surface, the wild black currant and the white stemmed gooseberry will prove far more dangerous as associates of the pines than the sticky and prickly currants. The latter are generally low in production of the late summer-stage spores.

The study is particularly important to control measurers for if, on the basis of equal units of leaf area, one species is, let us say, ten times more dangerous as a producer of pine infecting spores than another, it is quite apparent that it will be necessary to give greater attention to this species than to the less susceptible one in eradicating *Ribes*. The study must be continued and extended for several seasons yet.

In the study of the annual development of the rust, data are being collected on all species of *Ribes* encountered. Our data show that for practical purposes the only adequate method of determining the relation of the species in their reaction to the rust is by studies in nature. The best bases obtainable in the greenhouse can do little more than establish whether a species is susceptible or whether it approaches immunity or is immune.

As rapidly as possible data are being collected upon the relative susceptibility and capacity to produce pine-infecting spores for *Ribes* important as associates with sugar pine. Not all have been studied, but of those which have, all will be congenial hosts for the rust. These species are: red flowering currant (*R. sanguineum*), squaw currant (*R. cereum*), gummy gooseberry (*Grossularia lobbii*), and coast black gooseberry (*G. divaricata*). Red flowering currant and coast black gooseberry are particularly susceptible.

DAMAGE TO WESTERN WHITE PINE

In the study of damage to the western white pine three plots have been laid out at Daisy Lake, B. C., the worst of the infection centers. Here the rust has been present since 1913. The first plot covers a third of an acre. It is located in a veritable infection hot-bed with small pines from 15 to 20 feet in height growing in moderately dense stand under a light crown canopy of alders and poplars and among large numbers of very susceptible *Ribes*. The conditions here in this moist, thinly shaded natural inoculation chamber under the alders and poplars appear

ideal for infection, and the trees are literally covered with cankers. Usually the rust kills the tree by growing through an infected branch to the stem and girdling the stem, but here the cankers are so numerous that death has resulted from killing of the branches. Over a third of the trees had been killed in 1922, nine years after the establishment of infection in the locality, and practically all are dead now.

The second plot is about twice the size of the first and a short distance from the main concentration of *Ribes*. On it the trees range to larger size. Infection is generally much less abundant than on the first plot and the degree of infection is a good deal lighter for the larger trees than for the smaller ones. About 10 per cent, all in the smaller classes, have been killed.

In order to determine what damage was likely to occur to the larger trees on the second plot, the majority of those over 80 feet in height were climbed. Twelve trees ranging from 80 to 95 feet in height were examined in this way. Of these 12 trees, seven have cankers just entering or about to enter the stem as far as 15 to 25 feet down from the growing tip. One had a canker which will undoubtedly get into the stem 35 feet below the tip. Of the remaining four, only one seemed to have any chance of escaping such stem cankers within the next few years. The diameters of the trees at the lowest points at which stem cankers were entering or were threatened, ranged from 4 to 7 inches. For the seven trees in which the establishment of these cankers is a certainty, the tops above the point of the canker may be expected to die within 4 to 8 years. This study should be extended to still larger trees in this and other localities.

The third plot, covering one-fourth of an acre, is located about 300 yards from the heavy growth of *Ribes*. On this plot the trees are small, as on the first plot, but more exposed and mixed with other coniferous reproduction. Infection on this plot is light because of the distance from the main body of *Ribes* and the relatively slight representation of these plants in the immediate vicinity. Over a third of the trees still show no infection.

Heavy damage has as yet been limited to the points where large numbers of susceptible *Ribes* are present in the immediate proximity to the pines. While this damage is confined to the smaller trees generally, indications are not lacking in places, such as on the plot noted above, that severe injury and even death will soon result to some of the trees up to as much as sixty-five feet in height. The evidence given above for the second plot, furthermore, clearly indicates that in such

localities the rust will soon take out from 15 to 25 feet of the tops in trees up to 95 feet in height and probably larger.

In general, the rust has shown itself thus far in the West to be a serious disease primarily of the younger trees and it may be said that even where susceptible currants and gooseberries occur scatteringly in a stand of young western white pines there will be no chance of this stock producing a merchantable crop with the rust present. Damage will be less, and slower of development, with increase in the size of the trees. It is a question whether significant commercial damage may occur on fully mature and overmature stock as it is considered here in California. This subject and the question of the degree of susceptibility of sugar pine requires further study and every effort is being made to obtain data on these points. For several years our plans have called for a study of infection in the larger trees at different infection localities, but such a study would involve climbing the trees and therefore considerable expense, to cover which funds have so far not been available. It is hoped that the study may be inaugurated this year. In order to obtain data on the susceptibility of different white pine species and particularly sugar pine, various nurseries were canvassed for seedling stock two years ago but they could not supply the requirements for the study and so we are growing stock from seed. It is likewise planned this year to ship a number of small trees from the old Feather River Experiment Station into infected territory for the same purpose.

A number of other problems are being studied, two of which deserve special mention at the present time. One is the question of the distance of spread from currants and gooseberries to pines. In one or two places it appears that large groups of very susceptible *Ribes* are responsible for severe damage to young pines at distances considerably greater than 300 yards, in fact, over distances of a half mile. These cases are evidently exceptions, however, and it appears that in eradicating these plants from pine areas a border of 300 yards will be sufficient in the West as it is in the East.

Another question which has required study is that of differentiating white pine blister rust from its close relative, pinion blister rust on currants and gooseberries. The latter rust is common in California. The two species are so similar in their development on *Ribes* as to be indistinguishable with certainty by ordinary means. This study is being handled by the Office of Forest Pathology at Washington, D. C. Means have been developed there for differentiating the species in the early-summer spore-production stage, but a means of differentiation when the rusts are in the late-summer spore-stage is still lacking.

THE PROBLEM OF BLISTER RUST CONTROL IN CALIFORNIA*

By Stephen N. Wyckoff
Pathologist, Office of Blister Rust Control,
Bureau of Plant Industry

The discovery of white pine blister rust in Oregon during the autumn of 1925 necessitates the rapid development of a systematic plan of local control for the sugar pine stands of California. The protection of large areas of any susceptible species of white pine represents, in its several steps, a unique problem, because of the necessity for close cooperation between several varied interests and classes of technical workers. Because of the large present and future values threatened by the inevitable spread of blister rust into the sugar pine forests of California, the various agencies who must do the necessary work should be appraised of their responsibilities, and the several lines of work instituted.

The final objective of the measures here described is the protection of local areas of susceptible pines by the removal of all wild or cultivated currants and gooseberries (*Ribes*) from within and near such areas. This is termed local control. The protection thus afforded to the white pine timber and reproduction is due to the relatively short distance of spread of this disease from infected *Ribes* to pines. Under eastern conditions this distance is normally about 900 feet. Further investigation will show if this width zone is sufficient in western forests.

Such work involves several preliminary steps, each an integral part of its proper development. The entire program, including both the preliminary work and its final application, may be classified as follows:

1. Preliminary protective work. Delay of rapid spread of the disease into the threatened region by:
   a. Promulgation and enforcement of quarantines.
   b. Eradication of cultivated black currants.
2. Experimental work leading to local control:
   a. Small scale experiment on eradication of wild *Ribes,* both by mechanical and chemical means, to develop methods suitable to the region.

* Read at the January 15, 1926, meeting of the California Section, Society of American Foresters.

   b. Ecological studies to determine factors limiting the occurrence and growth of the *Ribes* species occurring in the region involved.
   c. Pathological investigations on relative susceptibility of host species and rate of damage to timber species.
   d. Extensive reconnaissance to determine factors involved in general application of local control, and to give a basis for estimate of time and expense involved in such application.

3. Investigations in silviculture of the timber species threatened, to determine:
   a. Means of securing maximum yields possible on areas which must stand the cost of protection.
   b. Possible saving in cost of *Ribes* eradication through special silvicultural practices.
4. Investigations in forest economics, to determine the future value of reproduction stands threatened by blister rust.
5. Application of a general local control program, in accordance with the principles and findings of the preliminary work.

The several lines of work here enumerated are not to be taken up in chronological order; due to the fact that several of them are of considerable duration, they should be instituted as rapidly as possible. It is, in fact, of importance that so far as possible they be carried on coincidentally, as progress on one problem may influence the trend of another. Of greatest importance is the realization that these lines of work are best undertaken by several independent agencies, working toward a common end, their efforts at first seemingly far apart, but the common objective becoming more closely apparent as it is approached.

The preliminary protective work serves a double purpose. First, every year gained in delaying the spread of the rust into a region containing large areas of susceptible pines, means that a year of increment is added to the (bodies of) threatened timber. In such a region as the sugar pine belt of California, containing approximately 38 billion feet of merchantable sugar pine and considerable advanced reproduction, such an increment may have a large value. Secondly, a period of grace before the actual advent of the disease is invariably needed to complete the several experimental and investigational projects designed to develop protective methods, secure their proper correlation, and assure their application. Every moment of this period should be put to good use.

In this respect, the West has a unique advantage. There are few cases in the history of the advent of new pests into either forests or cultivated crops in which the owners of the threatened values were forewarned, were certain of the eventual entry of the pest, and were thus given the opportunity to prepare for it. This advantage should not be lost.

The danger of spreading blister rust rapidly into uninfected regions is one which can not be disregarded. The work of the Office of Blister Rust Control in assisting to enforce State and Federal blister rust quarantines is indicative of this. During the proper season of each year, inspectors are stationed at strategic transfer points, to inspect plant shipments by parcel post, express and freight. Numerous cases are found of *Ribes,* in leaf and thus capable of carrying the disease, and of white pines being shipped out of infected territory.

The eradication of the cultivated black currant (*Ribes nigrum*) is necessary both as a delay and as a final protective measure. This plant, a native of Europe and only occurring under cultivation in North America, is the most susceptible of all *Ribes* hosts of blister rust, and constitutes the most serious menace of both introduction and intensification of the disease. Due to its great susceptibility it can become infected 100 miles or more from infected pines. It then produces large quantities of pine-infecting spores, infects pines for greater distances than any other *Ribes,* and thus intensifies the disease at the initial point of infection. So serious is the menace of this plant that the United States Department of Agriculture strongly opposes its growth in any state in which white pines naturally occur or are planted. In Idaho and Oregon the possession of this plant is a punishable offense, and Montana and Washington maintain quarantines against its planting and growth.

In securing the preliminary protection and delay in the spread of blister rust, the forester must turn to the horticulturist and the quarantine official for assistance. The owner of cultivated black currants must be shown the danger involved in his bushes, even when they are not in close proximity to white pine stands. Although his black currant bushes may be a considerable distance from any white pine forests, the danger still remains of original introduction of the disease into the region, with the consequent spread, by means of other cultivated or wild *Ribes* and by scattering native or even ornamental white pines. In the state department of agriculture is vested the regulatory power to enforce quarantines and any legislation which may be enacted against the cultivated black currants.

With elimination of cultivated black currants and quarantine enforcement under way, the experimental and investigational work leading to the development of local control practices should be instituted. Local control is based upon *Ribes* eradication, and methods of eradication will vary with the kinds and numbers of *Ribes,* and forest and topographic conditions occurring in different regions. The best method now known for *Ribes* eradication is hand-pulling by crews of men under the supervision of trained leaders. Eradication by application of toxic chemicals holds considerable promise of success, particularly for western conditions where *Ribes* may occur in large numbers in limited localities.

The first season's experiments in *Ribes* eradication should be limited in scope. Their objective will be, not the covering of a maximum acreage, with the development of an average cost per acre, but rather the careful analysis of factors affecting the cost and efficiency of such work, and the development of methods best suited to those conditions. Such an experiment should be conducted in the optimum range of the timber species the program is designed to protect, and on a local area representing favorable growth and reproductive conditions for this species. Such work should be increased in volume, year by year. It is only by attempting promising methods on a large scale that their true cost and efficacy can be ascertained.

Experimental work on the possibility of eradication of *Ribes* by means of application of chemicals is now under way in Idaho. As rapidly as suitable methods are developed, they can be experimentally extended to California. Further investigative work is necessary on this problem, and some of this work may be developed, on a cooperative basis, at the University of California.

The ecological study will attempt to determine the factors affecting the growth of *Ribes* in the white pine forests concerned. Knowledge of these factors is necessary in the proper development of local control practice. Such knowledge will affect methods of eradication, and will determine the time before a second eradication will be necessary. Experimental local control in northern Idaho has shown that definite knowledge of these factors is of great importance in developing methods of *Ribes* eradication. If these factors are understood, it may be possible to so direct methods of eradication, or of forest management, as to inhibit further *Ribes* growth in the forested areas on which control is being practiced.

As far as possible, the pathological investigations should be carried

on coincidentally with the several other experimental projects. Such investigations are an integral and important part of the experimental program. Unfortunately, it is not possible to conduct them in an area prior to the entry of the disease. And the establishment of the host plants in distant areas where the disease already occurs often presents special difficulties. These problems are, however, being successfully met by the Office of Forest Pathology, and technical investigations are being conducted in British Columbia. As rapidly as possible information will be secured on the susceptibility of the *Ribes* occurring in the sugar pine forests of California.

Reconnaissance should accompany and follow rather than precede experimental eradication, for the reason that conditions recognized in the course of the reconnaissance must be interpreted in terms significant to eradication. This reconnaissance should determine the location and extent of sugar pine timber types, the ownership of such lands, the amount of sugar pine timber and reproduction present, and the distribution and occurrence of *Ribes* and of physical factors affecting costs and methods of local control. The amount of actual field work necessary for such a reconnaissance depends upon the information already available from timber surveys. The final results of this reconnaissance will be a comprehensive plan for the application of local control over the entire region, or parts of it where local control is considered advisable, with an estimate of the time and money necessary.

The experimental and investigational work here described lies in the province of the specialists trained in blister rust control work. The foresters, however, to whom the entire control program is of greatest significance, and who are finally responsible for its application, have a definite and essential part to play in its development.

Irrespective of other timber values existing on the ground, the cost of blister rust local control is properly chargeable only against the white pine or sugar pine. It is therefore apparent that areas in California upon which blister rust local control is practiced should, in the future, when our forests are on a sustained yield basis, be made to produce the greatest possible yield of sugar pine. In order that proper management and silvicultural practice may be established, studies should at once be undertaken to determine methods of securing maximum yields of sugar pine in second growth.

As the ecological studies progress, more information will become available concerning the factors affecting the growth and occurrence of the *Ribes* of the sugar pine region. As this information is presented

to the foresters, they should carefully examine it, to determine its possible relation to sugar pine management. It is not impossible that certain modifications in management practice might profoundly affect the growth of *Ribes,* thereby saving some or all of the cost of eradication. Such a possibility is becoming increasingly evident as ecological and control reconnaissance work is carried on by this office in the western white pine stands of north Idaho. It is now recognized that fully-stocked native white pine stands in that region will have few, if any, *Ribes* in them. If the stand is sufficiently dense, this condition will exist even in the younger age-classes. The obvious explanation of this phenomenon is that the *Ribes* are very soon shaded out of dense stands; ecological investigations now under way should prove or disprove this explanation. But be the reason what it may, the fact remains that *Ribes* are fewer and the cost of eradication is much less in fully-stocked stands than in understocked ones. In this instance, the possibility exists that, with blister rust as a factor, it might in the future be better silvicultural practice to encourage the growth of very dense reproduction, which would probably contain a high percentage of inferior species, and later to release the white pine from this otherwise undesirable competition. The deleterious effect on the early growth of the white pine might be compensated by the reduced cost of local control.

In such matters as this, the ecologist and the blister rust control specialist can determine certain facts, but the significance and application of these facts is in the hands of the forester. He must weigh them in light of his specialized knowledge, and decide as to their use.

A program of blister rust control connotes and necessitates several considerations bearing directly on forest economics. Of great importance is the necessity for decision by the timber owners concerned as to whether they consider it economically advisable to protect the white or sugar pine which they own. This decision involves consideration of the spread in value between the white or sugar pine and the other timber species occurring on the land, and the owner's conception of the value of this pine at the time of its maturity. This decision must be faced by every white or sugar pine timber owner, including the Federal government.

In considering sugar pine in California, three distribution areas can be recognized. These are, in order of decreasing extent, (1) the botanical range of the species, (2) the commercial range of the species, and (3) its optimum range. The optimum range, representing the most favorable growth conditions for the species, should be first considered

in the development of local control plans. Experimental local control will give reliable figures on the cost of this protective work. This cost will be balanced against the pine values now existing, or recognized as obtainable from reproduction. If it is considered economically feasible to give protection to the sugar pine within this optimum range, the decision should then be extended to areas on which commercial sugar pine can be grown in lesser amounts. In the decreasing scale of volume of sugar pine obtainable from these areas, the point should be determined below which it is not economically sound to protect the pine.

As these several experimental and investigational projects progress, their inter-relation will become increasingly apparent. Each one bears directly on the protection of the threatened pine values. But knowledge of the exact method of protection, of the maximum returns to be obtained on protected areas, and of the need for protection can only be secured by correlation of the results of these various projects.

General application of the local control program should be undertaken as rapidly as it is developed. It should precede the actual entry of the disease, for three reasons. The first and most cogent one is that if protection is undertaken only when the rust is actually discovered in a stand of timber, considerable infection will probably have taken place, and damage, not apparent until a few years later, will surely result. Secondly, because of the large territory to be covered, it is highly possible that no infection will be discovered until it occurs in a number of places. The history of scouting for this and other forest diseases shows that the discovery of one point of infection, at first thought to be a single outpost in the forward thrust of the disease, is very frequently followed by the finding of numerous infection centers in the same or in nearby localities. Such discoveries, and the resultant necessity of immediately protecting the several infected areas, put an undue strain on the organization of the local control work, and may result in inefficient or unnecessarily expensive work. Thirdly, the steady and progressive application of the local control program will permit the proper development of a directive personnel. *Ribes* eradication is a highly specialized job. While the crews can, at the beginning of each season, be largely recruited from inexperienced men, the work is almost sure to be excessive in cost and low in efficiency unless thoroughly trained and competent foremen and supervisors are available.

The local control program, then, should be applied in a steadily increasing scale. The work should begin in that part of the region in which infection is most likely to occur first. It should progress away

from this point, gaining in momentum and volume as rapidly as men can be trained to carry it on efficiently. History of the disease shows that it is very unlikely that such a program will be carried out to completion before the advent of the rust.

During 1926, experimental *Ribes* eradication and control reconnaissance will be started in California. The Office of Blister Rust Control, with the assistance and collaboration of the forest service, has selected an area for eradication on the Stanislaus National Forest. Control reconnaissance will be largely confined to this same forest, with the expectation that such work will be extended in scope in the future.

The proper development of a program of local control of blister rust in California is then, dependent upon the cooperation of several agencies. The California Department of Agriculture, under the direction of Mr. G. H. Hecke, has for several years been doing work of inestimable value in preliminary protection of the sugar pine stands. In cooperation with the Bureau of Plant Industry and the Federal Horticultural Board they have conducted a campaign of quarantine enforcement and cultivated black currant eradication. This work has been greatly aided by the active assistance of the California State Board of Forestry, with Mr. M. B. Pratt as State Forester, the University of California, the U. S. Forest Service and the lumbering interests of the state. But the southward spread of the rust into Oregon makes it imperative that the experimental and investigative projects be started. These cover experimental *Ribes* eradication, ecological studies, reconnaissance, and pathological investigations by the Bureau of Plant Industry, investigations in silviculture and management and forest economics by such agencies as the Forest Service, the State Board of Forestry, the School of Forestry and the private lumbering interests. Such a program will extend over several years, and it will only be by good fortune that it is completed before the rust appears in California.

OBSERVATIONS ON WHITE PINE BLISTER RUST IN GREAT BRITAIN AND DENMARK

By J. S. Boyce
Office of Investigations in Forest Pathology
Bureau of Plant Industry

Observations on blister rust (*Cronartium ribicola* Fisch.) in Great Britain during the period from June to October, 1925, being incidental to the study of the *Phomopsis* disease of Douglas fir, were necessarily fragmentary and very limited. In Denmark, while only one place was visited, this was for the definite purpose of seeing blister rust conditions.

THE RUST IN GREAT BRITAIN

The disease came to notice first on June 9 in Bagley Wood near Oxford where a small plantation of eastern white pine (*Pinus strobus* L.) was very heavily infected. Of the trees from 3 to 8 inches diameter breast-high, many had already been killed, while the remainder were dying rapidly. Branch cankers were the exception, while stem cankers, in many cases just a foot or two above ground level, were abundant. The trees stood 100 to 150 feet distant from a few bushes of European black currant (*Ribes nigrum* L.) in a garden. Aecial sporulation was about over, while *uredinia* were just beginning to show as occasional spots on the currant leaves.

An opportunity was afforded here to compare the relative susceptibility of eastern white and Himalayan (*P. excelsa* Wall.) pines. Two trees of the first-named species about eight feet high were fully exposed to infected black currant bushes about 30 feet away. The trees had stem cankers and several branch cankers close to the stems. The two Himalayan pines of the same size as, same exposure to, and same distance from the black currants, were free from infection.

Uredinia and *telia* were very abundant on European black currants on September 2 at Westwick near Norwich. In one very heavily infected 10-acre block a new variety developed here and called the Davidson was relatively free from the rust. A second block of about 10 acres was similar to the above, while in a third block of 25 acres this variety also was very heavily infected. There were very few 5-needle pines on this estate, and the forester stated that 5-needle pines were rare in the surrounding country. Several Himalayan pines at some distance from the currants seemed free from infection, after a hasty

examination, as did two Swiss stone pines (*P. cembra* L.) about 500 yards from the second block of currants and relatively exposed. It is quite probable that these two stone pines belonged to the Alpine variety, *helvetica,* which as Spaulding (2, p. 44) has pointed out, is quite resistant. The amount and intensity of the infection on black currants at this place can be explained only by heavy uredinial spread, since the initial infection, if it came from pines, must have been light. The possibility of the rust overwintering on *Ribes* in this mild climate demands consideration.

One fact that stands out in relation to blister rust in Great Britain is the decided scarcity of wild *Ribes,* according to our standards. On some estates flowering red currant (*R. sanguineum* Pursh.) has been planted throughout the woods for its decorative value, but on the whole there are many places where 5-needle pines could be grown, the only protection necessary being the eradication of a few black currants. However, the British have abandoned the planting of 5-needle pines except for ornamental purposes. Even if the situation as outlined above were fully understood by the majority of foresters, there would be no change in the present attitude. In the first place, the black currant is highly esteemed. In the second place, British foresters feel that it is poor policy to plant an introduced species on a commercial scale when it is known beforehand that there will be an added charge against the species to protect it from a dangerous disease already established.

THE RUST IN DENMARK

The state forest of Almindingen comprises approximately 6,200 acres, in the central portion of the Island of Bornholm, a small, roughly circular island about 15 miles across, lying in the Baltic Sea about 100 miles east of Copenhagen. This place was visited by Moir in May, 1920, and by Spaulding in October, 1922, both of whom have given a brief account of conditions then (1, pp. 12-13, 17; 2, pp. 37-38). Eastern white pine, planted throughout the forest, both pure and in mixture with other conifers, has been practically ruined by blister rust and when seen by the writer in September, 1925, presented a depressing picture.

In the several compartments examined the white pines ranged from 3 to 14 inches diameter breast-high. Large numbers of trees have been killed and nearly all the living trees were infected, though occasional individuals apparently had escaped completely. All sizes were dying slowly but steadily, the death rate being slower than in

the earlier stage of the infection, since most of the small trees with cankers low on the trunk had been killed already. Many of the larger ones so infected were still living. Trees were very common with tops or even the entire crown broken off at cankers on the bole.

Stem cankers, abundant from butt to top, were indicated sometimes by distortion of the bole, but always by heavy resin flow. The dirty, black character of the bark or its dark green color due to a profuse growth of *algae* made the cankers more difficult to detect. A few twig infections were producing *pycnia*, others showed *pycnial* scars, and most of them had the characteristic yellowish-green discoloration of the bark at the youngest part of the canker except where this was obscured by the discolorations mentioned above.

Conditions are most favorable for blister rust, the relative humidity being high throughout the year, rainfall abundant at all seasons, and the winters mild. In addition, the low-lying, wet sites occupied by most of the white pine plantations are unfavorable to the tree species and favorable in a high degree to the parasite. Apparently heavy infection occurs periodically, and not yearly. Evidently such a wave of infection swept over the forest some years ago and the yearly infection since has been very light, the most recent cankers found being on 1920-1921 wood at the nodes. The white pines remaining were of low quality in all plots, because the stands have been so heavily thinned by blister rust that height growth has been reduced and the trees have not self-pruned. However, this is not of paramount importance since all but a very few trees will be killed before attaining maturity.

One noticeable point in this infection was the relatively few branch cankers in comparison to stem cankers. At Daisy Lake in British Columbia,—which place shares with this locality the doubtful honor of being one of the two worst examples of damage by blister rust now known,—the trees have enormous numbers of branch cankers, with very few stem cankers. At Daisy Lake, western white pine (*Pinus monticola* Dougl.) is the species attacked, while at Almindingen, eastern white pine is the victim. The writer's limited observations in New England also indicated relatively few branch cankers on eastern white pine.

During a three-day search no wild currants or gooseberries were found. The gardens of the small farms scattered throughout the forest and, in fact, over all the island, each contained a few European black currants, red currants, and often gooseberries. The black currants were heavily infected wherever examined but no rust was found on the red

currants and gooseberries. Evidently black currants alone are responsible for the pine infection in this forest. The most striking facts were the relatively small number of black currant bushes causing the heavy infection and the lack of significant difference in degree of infection between white pine stands 300 feet and those 3,300 feet from black currants. How much farther the disease might have spread from currant to pine can not be told, since no pine stands were found at a greater distance than the last-named figure. Conditions in this forest afford the most convincing proof of the terrific damaging power of the cultivated black currant. This currant can not be tolerated in a region where white pines are to be grown.

LITERATURE CITED

1. Moir, W. Stuart. 1924. White pine blister rust in western Europe. U. S. Department of Agriculture Bulletin No. 1186, 31 p., 15 fig., February 8.

2. Spaulding, Perley. 1925. Notes upon the white pine blister rust in Europe and upon conditions affecting its status there. Unpublished manuscript, 100 p., Office of Forest Pathology, U. S. Department of Agriculture, July 29.

THE WESTERN PINE BEETLE CONTROL PROBLEM

By J. M. Miller
U. S. Bureau of Entomology

Forest studies, like the trees with which they are concerned, must develop slowly. Often the forest investigator must wait years before he learns the result of some small part of his experiment. This is especially true of the efforts to work out a successful policy of protection against bark beetle infestations. Ever since Dr. A. D. Hopkins, some thirty years ago, advocated direct control measures against the *Dendroctonus* and other bark beetle epidemics, there has been a perceptible change among forest workers in the conception of the control strategy best suited to ward off losses caused by these insects.

In its basic factors the control of the western pine beetle (*Dendroctonus brevicomis* Lec.) presents a problem relatively simple compared with that of some other forest insects. This pest is of importance in only one host tree, western yellow pine. Serious timber losses caused by this beetle occur mainly in Idaho, Washington, Oregon, and California. Although it is true that it also attacks Coulter pine, a restricted tree species, and that its very near relative, the southwestern pine beetle (*Dendroctonus barberi* Hopk.), also attacks yellow pine in the southwestern states, economic phases of the problem are largely limited to the four states named above. In addition, the losses are more serious in overmature pure stands on the poorer sites. Therefore, the problem to start with is restricted as to host tree, region, and the conditions of the stand that favor attack.

These are all factors that should work to the advantage of the entomologist in developing control measures, but even with this apparent handicap against the beetle, fifteen years of investigations and applied control methods have failed to solve the problem to the entire satisfaction of the timber owners. There seems to be a general agreement among foresters and timbermen as to the need of a more adequate research program to improve methods of protection against this native enemy of our western yellow pine.

CHARACTER OF DAMAGE

There is little doubt that the western pine beetle is an old resident and has been established throughout its present range about as long as the forest types in which it thrives. It is essentially an enemy of mature and overmature forests. The losses are most severe in the drier

regions where yellow pine runs to pure stands. All the evidence indicates that as the timber has approached maturity crop after crop has been killed off by the attacks of this bark beetle. It can be said that the beetles practice a very fair system of selective logging, opening up the stand by means of group selection so as to stimulate advance reproduction. The young trees coming into the openings created by this group killing usually thrive until they reach the age or condition of growth which renders them susceptible to attack, and in time they succumb to another recurrence of western pine beetle epidemics.

Under the natural factors of control which operate to limit the forces of the beetles, the amount of timber killed annually on any one area is subject to great fluctuation from year to year. Quantitatively the annual losses may range from 10 to 400 trees per timbered section, from 50 to 1,000 board feet per acre, or from less than one-tenth of 1 per cent to 4 per cent of the stand. It is not the loss of any one year but the persistence of these losses year after year through long periods that makes them formidable to the owner. The ability of this beetle to maintain its numbers so that a certain amount of timber is killed each year, regardless of adverse natural factors of control and the efforts directed against it by man, has made its control one of the most difficult problems in forest protection.

BASIS FOR CONTROL METHODS AND STRATEGY

Control methods, to be entomoligically as well as practically sound, must be based upon an adequate understanding of the life history and habits of the insect. From this angle it can be said that the major activities of the beetle have been fairly well understood for some time. Its method of attack on the tree, oviposition, larval habits, period of seasonal activity, and number of generations produced annually have been determined to the point where it is definitely known in what stages and at what periods the beetles can be most effectively killed.

However, successful control strategy calls not only for a knowledge of the life history of the beetles but also for an understanding of the general system under which they develop their attack. This depends to a great extent upon the distances that the beetles fly and the manner in which they spread their attack through the forest.

Not only the aggressive tendencies of the beetle itself, as modified by climatic conditions and its natural enemies such as parasites, predatory insects, and birds, but also the physiological condition of the tree as affected by drought, defoliations, fire injuries, etc., must enter into

the reactions that govern bark beetle situations. The interrelations between the attacks of the beetles and the resistance of the trees present problems of extreme complexity, but it seems to be here that we will find the explanation for the differences in the character of the epidemics due to certain species of *Dendroctonus* beetles. The western pine beetle differs radically from other important tree-killing beetles of western forests in the character of its epidemics.

The Black Hills beetle, as it becomes aggressive, attacks in mass formation, causing spectacular killings in which it takes the entire stand over considerable areas. It attacks trees of all classes and shows no preference for either slow or fast growing trees, taking the general run of trees in the stand as it comes to them. This habit also characterizes the mountain pine beetle in lodgepole pine.

The western pine beetle, on the other hand, uses quite a different style of attack. Its system suggests the open skirmish line rather than the mass formation, since the trees which it kills are distributed in a fairly uniform manner throughout the entire infested area. Under endemic conditions infested trees usually occur singly or in groups of two or three. As the infestation increases to the epidemic form the groups become larger, the trees in them ranging in number from 10 to 75, but always these groups are fairly well distributed throughout the forest. There is no tendency for the invading army of beetles to concentrate the entire attack upon any one part of an area.

So far the only means that has been developed for meeting this offensive of the beetles is to reduce their numbers by artificial measures. Direct control methods, mainly burning and solar heat, have proven beyond question to be effective in killing the broods in all stages. There has been little development in our knowledge of the habits of the beetles or of control methods within the past decade. Such progress as can be claimed has been made almost entirely along the line of new conceptions of control policy. Our ideas as to when control work is most likely to succeed and under what conditions we can expect it to pay a profit are much better crystalized than they were ten years ago. This has been made possible by the study of the results of a long series of control projects which have been under way in California and Oregon.

RESULTS OF EARLY CONTROL PROJECTS

The first efforts to apply control measures to this insect date back to the season of 1910. During that year the Forest Service undertook a study of the bark beetle situation in California and assigned a

ranger to make a survey of the areas in the district where the more serious conditions had been reported. Because of noticeable losses, several areas on the Klamath National Forest were first selected for control measures and plans were made to try out the methods that had been proposed in Bureau of Entomology publications. The Southern Pacific Land Company and the Forest Service, under the technical supervision of the Bureau of Entomology, started a cooperative project which covered about 20,000 acres and cost approximately $3,000. The work was carried on during the winter and spring periods and the method consisted of cutting the trees and burning the infested bark alongside of the log.

As this was the first undertaking of its kind, it was realized that the results could not be foreseen. According to the conceptions entertained at that time the problem seemed relatively simple. Control was largely a matter of killing the beetles. The volume of infestation was thought to be more or less of a fixed quantity. The beetles that emerged from one tree moved to another and killed that. By destroying the broods in one infested tree at least one living tree would be saved. If 75 infested trees were treated on a section containing 100 infested trees an attack on 25 trees could be expected from the next generation.

It was mainly upon these assumptions that control work was organized on other forests in California for a number of years following 1910. Private timberland owners were considerably interested and the majority of the projects were cooperative undertakings between private owners and the federal government. By the close of 1920 about $90,000 had been spent in treating 23 million feet of infested timber on 32 separate areas in California.

In very few of the projects undertaken was the annual loss more than 1 per cent of the stand and in many cases it was considerably less. The number of infested trees treated averaged from 25 to 75 per timbered section. No fixed standards were recognized as to the size of the area necessary to form a protected unit. It was conceded by all that removal of the infested trees from so small an area as a square mile would not protect the cleaned area from beetles coming in from the outside, so the projects undertaken were considerably larger in extent. As a rule the area covered in one season's work consisted of 10,000 to 20,000 acres defined by topographic features such as small watersheds. Such areas could be handled to the best advantage from an administrative standpoint and it was considered, or at least hoped,

that they were large enough to minimize the effect of outside beetles drifting into the cleaned area.

As the results of these early projects became apparent and were analyzed, it was evident that a rather disconcerting amount of infestation always developed on the control areas during the first season following the control work. This new loss, which was termed reinfestation, was anywhere between 15 and 60 per cent of the original volume of infested timber that had been treated. It was fairly apparent also that this reinfestation had no very direct relation to the amount of infested timber missed in the control work.

It was still further apparent that the amount of reinfestation which developed during the year following control work was enough to form the start of another increase. The infestation on the Craggy and Barkhouse areas, the first projects on the Klamath Forest, which were worked during 1912 and 1913, increased again at such a rate that by 1915 losses were as large as when the work first started.

Considerable difference of opinion developed among forest entomologists as to where the beetles came from to cause this reinfestation. Some maintained that the new loss came entirely from the multiplication of beetles left within the control area. Others believed that a considerable amount of the reinfestation was caused by beetles that flew in from adjoining unworked areas. This led to two rather radically different views as to the control strategy best suited to this type of infestation. Adherents of the first school maintained that more thorough work on a limited area so as to get practically all of the beetles offered the best chances for success. Others believed that spreading the work over a larger area so as to get from 60 to 75 per cent of the infested trees would be more profitable. The latter plan had been advocated by Dr. A. D. Hopkins and became known as the percentage principle of control. In effect it did not mean a deliberate attempt to get any fixed percentage of the infested trees, but a well planned effort to break up the infestation over as large an area as possible by treating the trees in the more important centers, leaving the natural factors of control to take care of the infestation that was left. Although considerable controversy has arisen over the interpretation of this principle, it has generally been found, in any case, to be the only basis upon which direct control can be conducted. No matter how thoroughly the control work is done on any area, only a limited percentage of the total infestation can be eliminated, as will be shown by some of the projects discussed later in this article.

Although the majority of the projects were successful in reducing losses to the extent that the work was a paying investment for the owner, certain disadvantages were brought to light which may be summarized as follows:

1. The methods that had been developed were expensive to apply and did not permit of a large profit to the operator.

2. The results secured were variable even when control was applied under conditions that appeared to be similar. Natural forces which could neither be analyzed nor controlled affected the situation and obscured the results of the artificial methods to a very appreciable extent.

3. The best results secured were transient in character and could not be expected to last more than a year or so.

IMPORTANCE OF NATURAL CONTROL FACTORS

About this time, owing to the results of studies under way by the Bureau of Entomology and the observations of forest officers and private owners, the importance of the fluctuating character of bark beetle losses was becoming better appreciated. It was found that on areas where there had been no artificial control, very evident decreases in losses sometimes occurred from natural causes. The infestation over a considerable area might continue to increase for two or three years, but this condition was always followed in time by a "break" or decline of the losses. These decreases usually came on suddenly and amounted to a reduction of from 25 to 85 per cent in the attack of one generation of beetles. Little was uncovered, however, to throw any light on the causes of these natural increases and decreases.

Usually artificial control work was started just after some conspicuous increase in losses had impressed upon the owners the seriousness of the situation. The attack was made, therefore, when the epidemic was at its height, and a decline could have been expected in many cases if no work at all had been done. Under these conditions control measures seemed very much like locking the barn door after the horse was gone.

MAINTENANCE CONTROL—THE SAN JOAQUIN PROJECT

These considerations led to the idea that the right time to attack a bark beetle infestation was not in the epidemic but in the endemic stage. Logically it should be less expensive to treat 25 trees than 75 trees, per section. If treatment of the 25 trees would prevent an in-

crease to 75 trees, then a loss of 50 trees would be prevented. This appeared to be the ideal system of protection as it offered a much better margin of profit upon which to work.

In 1917 Ralph Hopping and A. J. Jaenicke of the Forest Service and the writer took up jointly an analysis of the control problem with the idea of initiating some control projects which would be conducted altogether along experimental lines. A plan known as the Ashland Conference plan was proposed. The San Joaquin project resulted from this proposal although the cooperation originally planned was not carried into effect because of change in organization. Its purpose was to determine the possibility of preventing epidemics, and the term "maintenance control" was brought into use to define the system of protection that was to be applied.

An area of some 80,000 acres of yellow-pine type on the Sierra National Forest which had previously been under observation for some years was selected as the testing ground for the maintenance-control idea. For this type of forest the condition was regarded as epidemic, if the number of infested trees per section ranged from 25 to 50. Control work had been carried out during the period from 1913 to 1917 on parts of the area where losses of this severity had existed. The experiment was planned with the idea of trying out various methods and systems of application and carefully following the course of the infestation not only on the control areas but also on selected check areas representing as nearly as possible the same type and conditions.

In the five successive seasons during which this project was in progress the work was carried through three fairly distinct phases:

1. A general working over of the entire area to make sure that the infestation was everywhere reduced to an endemic condition, or an annual loss of 25 trees per section or less. This phase was completed in the spring of 1920.

2. Follow-up work, which consisted of a patrol of the entire area with small mobile crews of two or three men, and the treating of accessible trees as they could be found during the spring, summer, and fall periods. This work was planned so that the cost would not exceed 5 cents per acre. Its object was to detect increases as they were starting and to destroy enough of the broods to ward off incipient epidemics. Under this system less than 40 per cent of the seasonal infestation was destroyed.

3. A comparison of the effectiveness of control when applied with varying degrees of intensity to small individual areas of 4,000 to

6,000 acres. This phase of the experiment varied from a conscious attempt to treat from 40 to 50 per cent of the seasonal infestation by going over a unit once each season and treating only the overwintering broods, to an attempt at complete extermination by working throughout the entire season and treating every infested tree as soon as it could be found.

The results brought to light by this work emphasize the difficulties if not the impossibility of preventing insect epidemics by any direct control methods. Briefly stated, the project brought out the following:

1. Treatment of less than 40 per cent of the seasonal infestation did not maintain control of the western pine beetle. On the area of 80,000 acres worked with this intensiveness the amount of infestation increased and decreased to the same extent as on check areas where there was no control work. The effects of artificial control were obscured by natural influences which caused the beetles to increase or decrease.

2. By the most intensive work with the object of exterminating beetle losses on an area of 3,600 acres, it was possible to treat about 90 per cent of the total seasonal infestation. Failure to treat the remaining 10 per cent was due to failure to find the broods in green trees which did not show discolored foliage until after emergence. Work of this character was effective in holding down an increasing infestation. During 1922, a season of general increase, the loss on the extermination area was 48 per cent less than it was on the unworked check area. However, during 1923, a year of natural decline, the reductions on the check area were appreciably as great as on the extermination area.

3. After control work was discontinued in 1924 a general increase occurred, and within one season the extermination area was reinfested to such an extent that losses on it were equal to those on the check area.

The limitations of the San Joaquin project should be considered in any analysis of the results. The infestation at no time exceeded 40 trees per timbered section, and the areas worked intensively were small and were not effectively isolated. The distance which beetles may fly from one area to another, still an unknown factor, may have considerably influenced the results. For various reasons, mainly financial, it has not yet been possible to try out maintenance control intensively on completely isolated endemic areas, or on areas so large as to give assurance that the amount of reinfestation coming in from the outside would be but a relatively small factor in the situation.

Direct control work conducted over large areas against heavy annual infestations of from 60 to 400 trees per section has been pretty thoroughly tested out in the pure yellow-pine stands of northern California and southern Oregon since 1920. This work was undertaken largely upon the initiative of private timber owners who were determined to protect valuable stumpage against well established losses regardless of the lack of what could be considered refined control methods. Any method that would kill the beetles on a wholesale scale was considered worth while in the face of threatening losses.

CONTROL OF AN ISOLATED INFESTATION—ANTELOPE PROJECT

One of the most successful of these undertakings was the Antelope project, started by the Weed Lumber Company, in the fall of 1920, on a tract of 60,000 acres near Bray, Calif. The annual losses averaged around 180 trees per section, or 1.4 per cent of the entire stand. The plan was to carry on winter and spring control work, treating all infested trees that could be found and covering the entire area just as rapidly as was administratively possible. This area was protected on all sides by a break in the pine type, which made reinfestation from the outside extremely unlikely unless the beetles travelled in number for distances of three or four miles.

An entomological survey and plan of control was worked out by Mr. J. E. Patterson of the Bureau of Entomology, who still further cooperated with the company by furnishing technical supervision for the project. The area was covered by control work in the two seasons 1921 and 1922, nine million feet of infested timber being treated at a cost of $33,000. For three seasons following this work the losses remained less than 75 per cent of what they were for the three seasons before the work. In 1924, when decided increases following a drought occurred everywhere in the general region, the losses on this control area did not increase. Logging operations were pushed into the control area and these, as well as the effective isolation, are believed to have been important factors in the success of the project.

Isolation, however, is a condition which can only rarely be found in the type of area usually considered for western pine beetle control projects. The only apparent alternative for isolation is to carry the control over an area large enough to offset the reinfestation from beetles drifting in from outside areas. This condition seems to have been met by the extensive areas included in the Southern Oregon-Northern California project, which gives us a very good indication of

the results to be expected from control as applied under a wholesale program.

A MILLION ACRE PROJECT—THE SOUTHERN OREGON-NORTHERN CALIFORNIA

The undertaking which was organized at Klamath Falls, Oregon, in 1922 exceeded in extent of area covered, volume of timber treated, and total expenditures, all the work that had previously been undertaken in western pine beetle control. It included an area of 1,200,000 acres belonging to over 1,000 different owners, and the treatment of some 35 million feet of infested timber at a cost of $145,000.

In addition a study of the results of the project was made possible through the allotment of funds for an annual survey which to date has cost $15,000. This survey which has been carried on for four successive seasons has brought to light various new phases of the application of control methods.

This project involved the cooperation of the Klamath Forest Protective Association, the U. S. Forest Service, the Indian Service, and the U. S. Bureau of Entomology. The annual losses against which the attack was directed were epidemic, on some areas running as high as 300 trees per section.

Mr. F. P. Keen, who directed the entomological phases, outlines the plan of attack as follows:

"The ideal plan would have been to cover the entire area in one year. This was impracticable, however, because to do so would have involved the training of a large number of men in a specialized logging operation involving the cutting of 100 million feet of timber over an area of 1,200,000 acres. Therefore, the next best thing to do was to treat as many epidemic areas as possible on the edge of the project and then move across the area with the firing line, keeping the enemy in front and the conquered territory in the rear. So a three-year program was decided upon and the work was carried out on this basis."

During the first two years of this project the control was directed against an infestation that was decreasing from natural causes. Although the reductions on the untreated areas amounted to 16 per cent in both seasons the reductions on the treated areas were 42 and 43 per cent.

In 1924, when drought conditions everywhere favored a general increase of infestation, no reductions were secured on the control areas. However, on an average infestation on the control areas

worked that season increased 27 per cent, whereas on the areas not worked it increased 97 per cent. The difference, a net saving of 70 per cent, represents the extent to which the control work registered in holding down an increase.

In order to express the result of control in terms of money values, it is necessary to make certain assumptions. One can not say with absolute assurance just how much loss would have occurred on a certain area if no control work had been done. We can only assume that if no work had been done the loss on the treated areas would have been in the same proportion as that which actually did occur on untreated areas where similar conditions existed. On this basis the control work on this project up to 1925 accomplished saving of 47 million feet of timber at an average cost of $2.77 per thousand.

The great variety of conditions that were covered, the large volume of the work done, and the comprehensive study of results obtained give to this project considerable investigative value. The more important conclusions arrived at by Mr. Keen are the following:

"1. Fall, winter, and early spring work have given the best results so far.

"2. In order to secure tangible results, a large block of timber or a complete unit has to be treated in a single control season.

"3. The apparent effect of control has been decidedly localized to the units treated. No measurable effects have been noted for more than a mile from the work.

"4. No additional reductions from control have been secured the second year although reduction secured the first year may persist for some time.

"5. The most noticeable effect from control has been in units where increasing epidemics or epidemics already severe have been treated. The effects from treating endemic infestations have often been completely overshadowed by the effects of other factors. However, with a generally increasing infestation, control may not bring about further reductions, but will tend to prevent the increase on the treated units.

"6. In order to justify control work on an economic basis it is essential that the value of timber saved as the result of one season's control operation should equal the cost of the work. This is largely a matter of stumpage values. During the seasons when a declining epidemic was being treated it was determined that these values would have to be at least $4.50 per thousand to justify the cost of the work.

However, the most recent results of this project indicate that with an increasing epidemic infestation the reductions secured are so much more effective that control may pay in stands of less than $4.50 per M. B. M.

"Maintenance control, by which we mean the treating of the same area every year, is not justified when applied to infestations of less than 65 trees per section or 100 board feet per acre annual loss, unless the timber values are more than $7 per M. B. M. Treating any sort of an epidemic infestation above 65 trees annual loss per section is justified if the timber values are in excess of the treating costs, ($4 to $5 per M. B. M.).

"The evidence of the first year goes to show that where control is applied in advance of a material increase in infestation, enough timber is saved by checking the increase to warrant control measures even though the timber is worth only $1.27 per M. B. M.

"But as yet we have no reliable index as to when an infestation is going to increase, and so control work will ordinarily have to be justified on the basis of what can be accomplished against a balanced or decreasing epidemic.

"For conditions on the Southern Oregon-Northern California project, adequate pine beetle protection would involve the treating of valuable timbered units during any epidemic period but not the attempt to treat endemic conditions year after year. Under such a system, funds for suppression work should be available at all times. Every year that the area under consideration showed an epidemic infestation it would be treated. Under endemic conditions no work would be done except on the more valuable tracts."

These conclusions represent the most recent position that has been reached in the application of our present methods of western pine beetle control in commercial timber stands. It is evident that the methods are adaptable only to relatively large areas, where losses are already high, and where stumpage values are in excess of the annual cost per M. B. M. of treating the infested timber. Were it possible to predict definitely or to recognize the point at which an endemic infestation starts to break into the epidemic stage, it would be possible to carry on control work with much greater assurance as to the benefits that would be obtained, and lower timber values could be profitably protected.

Where forest trees take on exceptional values, as on recreational areas where there are a great number of summer home sites, National

Parks, etc., these methods can still be used with profit even though the volume of annual loss is considered endemic. As long as these methods are effective in reducing the quantity of beetles within an area they will materially contribute toward prolonging the life of the remaining living trees on the intensively used sites.

IMPROVED METHODS NEEDED

It is generally conceded that the methods now in use require much hard, manual labor and the cutting of large volumes of high-grade merchantable timber in order to bring about the destruction of relatively small quantities of bark beetles. As stated by an interested timber owner, the methods themselves are "crude and expensive." If it were possible to improve methods so as to reduce their cost and increase their effectiveness, they would, no doubt, come into much more general use. It must be admitted, however, that the possibilities along this line look none too promising. Artificial methods will always require the cruising out of the infested trees over the entire area that is to be protected, and the labor involved in this work alone is a rather formidable part of a control operation.

There is some possibility of developing biological methods of control, although it is very doubtful if the effectiveness of native insect parasites and predators and birds can be appreciably stimulated. The greatest possibilities seem to lie in uncovering some weak point in the life habits of the beetle which can be taken advantage of by direct control measures. Were it possible, for example, to develop artificially the attraction which causes the beetles to concentrate their attacks locally in certain trees, it would be an easy matter to trap them as we now trap flies.

POSSIBILITY OF CONTROL THROUGH FOREST MANAGEMENT

During the last few years the studies conducted by the Bureau of Entomology have been measurably broadened to include such factors as may influence the susceptibility of certain trees or of entire timber stands to bark beetle attack. In the early studies of this problem the insect itself was regarded as the primary active agent and the host tree was considered only as a passive medium which was attacked indiscriminately. It is now realized that the reactions of the tree must be considered as well as the activities of the beetles, and that the vigor of a tree has much to do with its susceptibility or its resistance to bark beetle attack. There is a very complicated as well as delicate balance between these forces which as yet is but little understood.

The resistance of a tree may be affected by climatic conditions, soil, defoliations, fire injuries, age, composition of the stand, and many other factors, some of which can be controlled through the management of growing stands. This angle of research work has been emphasized by Dr. F. C. Craighead in his recent article on "The Dendroctonus Problems" and in his supervision of the investigations now under way.

Studies which have recently been carried on by H. L. Person indicate that under endemic conditions the western pine beetle shows a decided tendency to select and kill the more slowly growing trees of the stand. It is in trees of slow growth rate that it usually builds up in numbers and becomes aggressive. Once it has become abundant, however, it attacks with much less discrimination and kills vigorous as well as slow growing trees by sheer force of numbers. However, the mortality of the beetles when attacking fast-growing trees is high, so that as a rule epidemics are short-lived in stands where fast-growing trees predominate. These discoveries open up the possibility of reducing losses through logging practice and of taking out most of the susceptible trees in the marking practice on sale areas so as to leave only the more resistant trees for seeding purposes and future cuts.

THE NEED FOR FURTHER INVESTIGATIONS

The more important requirements for further progress on this problem are:

1. Development of better and less expensive methods of direct control. These should increase both the certainty of a reduction of losses to be secured by their use, and also the margin of profit to the timber operator who uses them.

2. Determination of the natural causes which govern the increase or decrease of bark beetle infestations. If these were thoroughly understood it would be possible to foresee when an increase or decrease of losses was about to occur. We should then be able to determine when and where control work can be carried on with the greatest assurance of profit to the timber owner. A knowledge of these factors could also be applied in the management of future forests by practices which will reduce conditions favorable to epidemics.

These objectives can only be achieved by a well planned and adequately financed program of investigative and experimental work. The progress of our knowledge of the western pine beetle problem has been slow mainly because research work has been given a secondary position to that of the application of whatever knowledge was available at the time in protection of the values at stake.

WHERE IS THE FOREST BIOLOGIST?

By E. N. Munns
U. S. Forest Service

Before the age of specialization even in such a young profession as our own, all foresters were Foresters. Now, because of the increased breadth of the forestry field and the many activities in which foresters engage, we have the forest entomologist, the forest technologist, the forest ecologist, the forest pathologist, as well as others who either have kept the "forest" as a prefix or who have dropped the forest and have become known as landscapers, timber engineers, lumbermen, and recreationists. However, as one casts one's eye down the growing list of titles of those who claim forestry as a profession yet who have specialized to a greater or less extent, one fails to find anything that smacks of the "forest biologist."

True, in this long and worthy list one finds "wild lifers" and undoubtedly many in the list can qualify in some way or another as "sportsmen," while others can qualify more or less as ornithologists and some few as taxidermists, yet, with all these, the interest manifested is rather more avocation than vocation, for there are none in all the catagory who have had that special training and special experience in forest biology that would enable them to qualify as forest biologists.

We know what a forest entomologist is. He has had not only a forest training but also special training in the insect life beneficial or harmful to the forest. He has had also field experience largely along entomological lines, in determining the life history of forest insects and in determining their relation to environment. The whole aim of the forest entomologist is to work out all the related factors having a general bearing on the subject, that he may determine how best to manage the forest so as to keep the damage and the possibility of insect damage at a minimum and without the use of artificial control methods as far as conditions permit.

Similarly, the forest pathologist must have a forestry background with special training in the abnormal physiology of trees and their diseases. His approach to the problem, like that of the forest entomologist, is how so to manage the forest that diseases will be kept in check and losses held at a minimum. In this, control is again an evil, which the pathologist recognizes may be necessary in some cases, but which he is endeavoring to make unnecessary by proper forest management and forest sanitation.

But what is the forest biologist? The forest biologist is the forester with a sound forest training plus special training in zoology and animal ecology so that he also can contribute to proper silviculture from the standpoint of the forest animal population. He would not tackle a problem in the control of some animal pest from the standpoint of the animal alone, but would look upon control only as a final resort should forest management methods fail to keep the animal in check through natural means. In short, the forest biologist would not start on a wholesale destruction of some animal until he was sure that upsetting the natural balance would not react unfavorably to the forest, and not the forest as a stand of trees but the forest with the trees only as a part of the picture, the other parts being first, the other denizens of the woods—birds as well as mammals, insects as well as livestock; and second, the other flora of the forest—the underwood, brush, grass, and herbs; and third, the soil.

But what can the forest biologist do for forestry? I do not know whether back in the beginning of things this same question was raised as to the entomologist or the pathologist. Certainly no one today questions their place in forestry nor the importance of their findings in forest management. To my mind the biologist should do as much, and along not greatly dissimilar lines.

We are planting annually many thousands of acres to forest, and in some regions at least, we are finding that reforestation is a failure or costly because of rodents. In other regions only certain species are damaged, or damage occurs only in certain years or in particular localities. Why? What can be done? Control measures are perhaps possible, but they are costly. Why should these animals have so increased that they become destructive; is it because systematic trapping, unwise hunting, or forest fires have destroyed natural enemies, making possible their increase? Is it because the normal food supply has been destroyed by grazing, overcutting, fire? How soon will natural enemies increase to the point where they will take care of the situation and what measures of protection will be necessary to bring them back? Was their loss in the first place preventable and will the occasions that led up to their destruction occur again? We are cutting heavily our virgin forest and relying upon seed trees for reproduction: how far can we depend upon the seed produced to be actually released and sown; how will the loss of an abundant food supply react upon the rodent population and upon natural reproduction? What should be done? The loss of the chestnut is forcing squirrels in the Northeast to change their diet.

How far will this affect forest management? The young dense forest is crowding out grazing on many forest areas and reducing food for deer. What will they feed upon; how will the use of this new feed react upon the forest; can we manage the forest so as to retain an abundant wild life resource?

So one might continue, and illustration after illustration given indicating how the forest reacts upon animal life and how animal life reacts upon the forest. The problem is not a simple one: it is fully as complex as the disease or insect problem. It is a part of the problem of forest management in its full sense, the forest management that sees more than handling the forest for lumber. It is a part of the major problem of how best to use forest land and maintain a forest resource.

One reads of forests in Europe, but invariably one reads also of "forest, fish, and game." The forester is a game warden, the forester is a game keeper, the forester manages the game parks, the forester determines the kill, etc. The idea seems to be that the care of the wild life is a forester's duty and that the forester because of his activities must know also game and other animal behavior. Perhaps not all of these European foresters are not trained technical foresters as we understand the term, but the association of these subjects indicates a rather general belief that those who are close to the wild things of forest and field are in close touch also with the environment in which the wild life lives. Certainly the American forester is close to his environment and certainly he should be greatly interested in the animal life of the forest, not alone because of the forest as a shelter for this life but because also of the close inter-relationship between the forest and the wild life.

But why the forest biologist; will not the ordinary, common garden variety of biologist be sufficient? The answer will have to be in the negative. There is no question as to the value of the straight out-and-out biologist. His work is good and is needed. But to be of the most value he should be more than a biologist—he should be a Forest Biologist. He should have a forest training as a foundation upon which the biologic work can be built and to which it can be related. We can get much help from an entomologist, it is true, but the great assistance rendered forestry is not from pure entomologists who see the problems as problems in entomology, but from those who can relate their findings in terms of forest management. So with the biologist.

There should be a future in this field and there should be a big future too. Forest biologists should be in demand by gun clubs as

managers of properties from a forest and game point of view, where game *production* comes first. They should be employed in the States on game refuges and game preserves where game *protection* comes first. They should also be employed in state and federal organizations where the forests come first, but where game and all forms of wild life *relationships* are important. With the development of forestry the forest biologist will have a part to play in all forms of forest management. Wild life research from a forest point of view has not yet been undertaken except from the standpoint of control, but as in other lines of work, control is only part of the problem and should not be necessary under a proper form of management for our various forest types. This management is still in the future.

Much of the trouble with American foresters is that they are greatly troubled with myopia or even occasionally a lack of vision as to what the future will really be. We are too prone to look upon the forest problem as one of trees rather than envisaging forest management as a problem in handling a complicated and delicate natural being in which all environmental and biologic factors are interwoven into one. We are beginning to see the relationship of game to forest management, and recreation is here considered as a part of forest management, but game is only a portion of the biologic problem, for all forms of wild life are involved and each form plays an important part because of its relation to others whose relationship is too often not recognized, or if so, but dimly.

SUMMARY OF LITERATURE RELATING TO THE VOLUME, DISTRIBUTION, AND EFFECTS OF MEDULLARY RAYS IN WOOD

Compiled by
ARTHUR I. WEINSTEIN
Forest Products Laboratory

The literature on medullary rays, dealing with the various phases of their distribution in trees growing under favorable or unfavorable conditions, their effect on the physical and mechanical properties of wood, and their value in identification of different woods, though scanty, covers a period of several decades at least, and has been found scattered through many publications as well as in some unpublished works. A condensed summary, giving the main points of the more important articles examined, is presented in the following pages.

VOLUME AND DISTRIBUTION IN SOFTWOODS *(Gymnosperms)*

Myer (*22*) investigated the ray volumes in 38 species, representing 12 genera, of softwoods. In the whole group he found an average relative volume, with respect to total wood, of 7.8 per cent, the extremes being *Thuja occidentalis* with the low volume of 3.4 per cent, and *Pinus heterophylla* with the high relative volume of 11.7 per cent. Variations within a species in all 38 species fluctuated within relatively narrow limits, the average variation from the mean being 2.0 per cent. The extreme variation from the mean varied with the species, being at a minimum, 0.4 per cent, in *Pinus strobus* and *Picea canadensis,* and at a maximum, 5.2 per cent, in *Abies grandis.* The latter and *Larix laricina,* with 4.2 per cent, were the only species out of 38 with a deviation greater than 4 per cent.

Essner (*7*) studied the distribution of rays in different parts of the tree in 16 species of softwoods, representing ten genera scattered among the *Abietineae, Cupressineae, Taxineae,* and *Araucariae.* He found that at a given height in a tree trunk the number of medullary rays in the different annual rings is not constant, but shows the following relationships: The number of rays[1] is largest in the first annual rings; then it decreases toward the outside of the trunk at first rapidly, then more slowly, until the number becomes constant throughout a zone which varies in width in different individuals. Finally, the number of rays again increases in rings put on after the "maturity"

[1] The *volume* occupied by the rays does not necessarily follow the same rule.

of the tree. The difference thus developed between the minimum and maximum number of medullary rays in rings at the same height in a tree trunk is considerable. The minimum is frequently only half the maximum, and at times falls far below that. In *Pinus strobus,* for instance, the maximum of 99 rays per square millimeter is in the first annual ring, while the minimum of 35 rays per square millimeter is in the sixtieth annual ring. Similarly *Taxus baccata* showed 149 rays per square millimeter in the first annual ring and 65 rays in the twentieth; *Gingko,* 92 in the first and 35 in the fifty-fifth ring; *Juniperus virginiana,* 126 and 80 in the first and fortieth ring respectively. With but a single exception the maximum number of rays was found in the first annual ring. The ring containing the minimum number of rays was found at different ages in different species, but no data are given as to the uniformity of its age of occurrence or the rate of increase of rays thereafter in any given species.

As to the distribution of medullary rays at different heights in the tree, Essner (7) found that the greatest number of rays in *Pinus strobus* is generally in the first two meters of the trunk. Above this region the number of rays is constant throughout a zone varying from 2 to 12 meters in height in the first 30 annual rings. The later annual rings show a steady decrease in number of rays with increase in height of the trunk.

Jaccard (15), working on *Sequoia sempervirens, Picea excelsa,* and *Abies alba,* observed that the average number of rays in the stump disc, i. e., in a section about 15 or 20 c. m. above ground, is markedly greater than in the remaining height levels in the trunk. The number of rays decreases up to a level in the lower third of the stem, where it attains the least value per surface unit; above that level the number again increases gradually towards the base of the crown.

Jaccard noted also that there is a correlation between the size of tracheids and the number of medullary rays. He found that, in general, the medullary rays are more numerous and not so tall in the organs of parts which have the narrowest tracheids. Essner (7) noted, similarly, that reduction in number of rays with increase in age proceeds concurrently with the increase in width of the vertical elements. For *Pinus strobus* he gives the following figures:

Number of Rays Related to Age

Annual ring	1	5	10–20	40	80
Number of vertical elements[2].....	60	40	35	28	30
Number of rays across field of same size..........................	20	10	7	6.3	6.3

In branches Jaccard found that the rays are more than twice as numerous as in the trunk, but that there is no regular increase in number of rays with the height of the branches above ground. In Sequoia the lower side of branches, which consists of rounded, thick-walled tracheids, is more abundantly supplied with medullary rays than the upper side.

In eccentric growth, according to Essner, the number of medullary rays along the short radius is almost the same as along the long radius. In an eccentric stem of *Biota orientalis,* with a short radius of 60 millimeters and a long radius of 125 millimeters, the number of rays was 92 and 94 per qmm. along the respective radii.

On the other hand, in a perfectly concentric *Cupressus sempervirens* stem, the number of medullary rays along opposite radii differed markedly, being 83 per qmm. on one side and 62 per qmm. on the other.

Height of medullary rays.—During the first year the majority of rays are only a few cells in height. With increase in the age of the trunk the prevailing rays are many cells high, while production of low rays diminishes or ceases. The prevalent height, however, is in no case the maximum height which some rays reach. There is a marked difference in the height of rays at different levels in the same annual growth layers. Height of rays also varies in different individuals of the same species.

VOLUME AND DISTRIBUTION OF RAYS IN HARDWOODS *(Angiosperms)*

Myer's (22) investigation of ray volumes in 54 species (22 genera) of hardwoods showed an average volume of 17.04 per cent of the total wood. The extremes were *Tilia heterophylla,* with 5.3 per cent, and *Quercus densiflora,* with 42.26 per cent. Forty-four species showed an average deviation of 4.7 per cent from the average volume of the rays. No variations are stated for the 10 species of oak. The minimum fluctuations in specimens were found in *Betula lutea,* 0.9 per cent; the maximum in *Acer negundo,* 11.8 per cent.

[2] Reduction in number of vertical elements goes with increase in their width.

The three genera of hardwoods, the willows, poplars, and chestnut, possessing uniseriate rays alone showed an average volume of 10.67 per cent with a maximum divergence of 6 per cent between extremes. The diffuse rays, which are widely distributed among the hardwoods, showed, on the other hand, a larger average and greater variation. Their average for 36 species and the three sections from each species was 14.13 per cent, with a minimum of 5.3 per cent in *Tilia heterophylla* and a maximum of 26.35 per cent in *Hicoria pecan.* Myer adds further that "the exceptionally large compound rays show the largest average of 28.08 per cent with a maximum of 42.26 per cent in the tanbark oak, and a minimum of 20.43 per cent in *Fagus atropunicea.*"

De Smidt (5) investigated the rays of *Ulmus fulva,* and his results were in close agreement with Jaccard's (15) observations on *Sequoia, Picea,* and *Abies.* He found that the total ray volume was at a maximum in the root and the stem base, next decreasing to a minimum higher up in the stem, then again increasing toward the base of the crown.

The volume of multiseriate rays surpassed that of the uniseriate at every section, even though the uniseriate type were greater numerically. The extremes were found in cuttings 0.61 meter and 20.11 meters above ground, where the volume of multiseriate rays amounted to 7.9 and 2.9 times, respectively, that of the uniseriate ray volume. The maximum volume per cent of the uniseriate rays was found in the crown.

An examination of ray volumes at different distances from the pith showed that the ray volume increases slightly with increasing age. The number of uniseriate rays remains nearly constant, while the multiseriate rays diminish in number and increase in size.

Hartig (13, 14) in his investigation of *Quercus rubra* found a decrease in ray volume as the crown was approached, which is in agreement with Essner's (7) results in *Pinus strobus,* and ascribed the reduction in volume to a diminution in the number of large rays. In horizontal section he found that the large medullary rays constitute only a small portion of the wood of a young tree. Thus, an oak tree had 4.1 per cent of rays in the fortieth annual ring, the volume increasing to 8 per cent in the one hundred and fortieth. The most abundant development of rays he found in the root where they constitute more than 20 per cent of the wood. Moreover he found that the greatest individual differences exist with reference to the number and width of the medullary rays. In *Quercus alba, Q. bicolor* and

Q. prinoides Eames (6) found that "the wood of the stem for a distance of several inches, or even one or two feet, above the root possesses only uniseriate rays." He adds that in some *Q. alba* and *Q. bicolor* trees, 15 to 20 years old, only uniseriate rays existed, and when the multiseriate rays appeared in these species, they were formed, as in black oaks, rather abruptly.

EFFECT OF GROWTH CONDITIONS ON THE NUMBER AND VOLUME OF MEDULLARY RAYS

Free access to light, with the concurrent freedom from crowding, seems to exercise a considerable influence on medullary ray distribution. Hartig (13, 14) found that fully illuminated oaks possess 10 to 12 per cent of rays, while less fully illuminated trees have from 8.4 per cent down to 3.7 per cent, depending on the amount of light accessible to the tree. An oak tree 140 years old and having 8 per cent rays was exposed to greater illumination of sunlight; the ray volume increased as a consequence, to 10 or 12 per cent.

Miss Langdon (20) in discussing the retarding effect of suppressed growth on medullary ray development in *Quercus alba* points out the following:

"In some of the older stems the development of wide rays has been retarded to such an extent that only uniseriate rays occur, even in mature 11 and 12-year-old wood; and in numerous specimens of wood 15 to 19 years old, taken from different regions of the same tree, wide rays are entirely absent up to about the tenth or eleventh year, when broad rays often appear abruptly."

The influence of the longer growing season in warmer localities, as compared with the progressively shorter season as the northern limit is approached, is pointed out by Myer (22) in connection with the high percentage of rays in the semi-tropical *Quercus virginiana* and *Quercus densiflora*—32.2 per cent and 42.26 per cent respectively. He ascribes this to the increased demand for storage tissues, caused by the greater total amount of sunlight available for photo-synthesis in the longer growing season.

Conversely, a short and cold growing season leads to a reduction in ray volume. Forsaith (9) examined microscopically *Betula glandulosa, Betula alba* var. *cordifolia, Alnus crispa,* and *Rhododendron lapponicum* which were collected from near the timber line on the Presidential Range in New Hampshire, and compared them with closely allied species from lower elevations. He says that "a marked reduction in the ray storage tissue was manifest in all specimens. In *Betula* the

major portion of the rays were uniseriate, aggregate rays were not apparent in the normal stem of *Alnus,* and there was a marked reduction of the compound rays in *Rhododendron.* Apparently such a diminution of the radial elements had been engendered by the cold, bleak conditions prevailing on mountain tops . . ."

Similarly (Myer, 22), lowland forms of ash, tulip poplar, and bald cypress showed a marked increase in ray volume over other typical representatives grown at higher elevations. Geiger (11) found differences in ray volumes in *Tectona grandis* growing in different parts of Java. He ascribes these to climatic differences and gives the following data.

Ray Volumes in Tectona Grandis

Medullary Rays	East Java 113°-111° East. Longit.		West Java 107° East. Longit.	
	Max.	Min.	Max.	Min.
Width (in number of cells)	11	1	6	1
Height of ray	145u	3u	52u	3u
Width of ray	30u	5u	35u	10u
Radial length of ray	120u	20u	105u	15u
Thickness of wall	2.5u	1u	4u	1u

He also describes the effect of soil conditions on ray development. Of three teakwood trees which he compares, all growing in the same region, RXII and RIII grew on "good calcareous loam," while RVIII grew on "poor calcareous loam." The height of the rays in number of cells was as follows:

RXII = 85 cells high
RIII = 105 cells high
RVIII = 37 cells high

Essner (7) also claims to have found deviation in ray development under the influence of growth conditions. He describes two spruce trees, "No. 1 growing under favorable conditions; No. 2 under unfavorable conditions," which had the following number of medullary rays per square millimeter:

Number of Rays and Growth Conditions

Annual Ring	Tree No. 1	Tree No. 2
1	72	66
5	45	..
10	45	63
20	..	64
26	41	..
40	..	73

He states further that the conditions under which these trees grew "are indicated by the diameters of their annual rings:

No. 1. 24 annual rings = 185 millimeters
No. 2. 41 annual rings = 140 millimeters."

Myer (22) ascribes the high average percentage of rays in hardwoods, 17.04 per cent, as compared with the comparatively low average of 7.8 per cent in softwoods, to the development of the deciduous habit under climatic control, thus automatically reducing the total storage area. In support of this he points out that the deciduous larch possessing uniseriate rays has an average volume of 10.5 per cent, which is only 0.13 of one per cent below the average volume of 10.67 per cent in the three genera of hardwoods also with uniseriate rays, the willows, poplars, and chestnut.

RELATION OF RAY VOLUME TO PHYSICAL AND MECHANICAL PROPERTIES OF WOOD

Myer (22) states that "density is directly proportional to an increase in ray volume." In softwoods he gives the maximum divergence from the mean for *Thjua occidentalis,* where a specific gravity of 0.32 was associated with a ray volume of 3.43 per cent. The minimum divergence is shown by *Libocedrus decurrens* where the figures are: Specific gravity 0.36 and ray volume 8.9 per cent. In hardwoods, the maximum divergence is found in basswood which has a specific gravity of 0.40 and a ray volume of 6.8 per cent, while the minimum divergence is represented by *Platanus occidentalis* with a specific gravity of 0.54 and a ray volume of 19.2 per cent. In commercial white oak Koehler and his associates (19) found that the anomaly of pieces of white oak with less wood fiber having the same specific gravity as pieces with a proportionately large amount of wood fiber "was largely explained by the discovery that, in general, as the amount of wood fibers decreased the volume occupied by the medullary rays increased." On the other hand, the data on ash and Sitka spruce compiled by Koehler *et al.* (18. Tables IV and VI) do not seem to indicate any definite relationship between specific gravity and ray volume.

As to mechanical properties, according to Myer, "a proportional increase in the numerical measure of hardness appears to follow closely an increase in ray volume. In the softwoods there is for each increase of one per cent of ray volume an increased resistance to indentation of five pounds per square inch, and in hardwoods a similar gain for each unit added to the volume of storage tissue."

He also states that the modulus of rupture and compression perpendicular to the grain "progresses in direct proportion to the increase in ray volume, while compression parallel to the grain shows a proportional increase only half as great when correlated with a similar gain in storage tissue in the different species of hardwoods."

Rays as a cause of brashness.—Forsaith (10) includes an increase in the volume of wood rays and storage parenchyma among the definite causes of brashness. Koehler *et al.* (18) found that in ash "the specimens tested in static bending, the tough averaged 48 rays per field and the brash 60; whereas, in the specimens tested in impact the tough had 59 rays as against 58 for the brash. Whether the larger number of rays on the average in the brash static bending specimens was responsible for the brashness of some pieces is difficult to say." In Sitka spruce there was practically no difference in the relative amounts of ray tissue present in the tough and brash specimens.

Permeability of rays to preservatives.—Teesdale (28) tested the permeability to creosote of 20 species, representing eight genera, of softwoods and found that "except in the case of ray ducts the medullary rays, as a rule, were not penetrated. In some of the spruces, however, the upper and lower ray tracheids were penetrated and in some of the pines the entire ray. In no case except the spruces and pines was any penetration noted in the rays unless the specimen was very heavily treated."

In testing 25 species (16 genera) of hardwoods he (29) came to the conclusion that "the medullary rays and other parenchyma cells appeared to be of little practical importance in the penetration of the hardwoods with creosote. In oak, hickory, and sycamore, for example, the rays were conspicuous because of their resistance to penetration in marked contrast to the surrounding treated tissue."

VALUE OF RAYS IN IDENTIFICATION

Owing to the fact that the number of medullary rays in similar annual rings of different individuals of even the same species, is subject to great variation, their distribution can not be generally considered of great diagnostic value. And though, as Essner (7) points out, differences in number of medullary rays between families and higher subdivisions, in softwoods, are more or less existent, there are many overlapping groups which make identification by means of rays unreliable. Thus, in general, the *Cupressineae* have double the number of rays of the *Abietineae,* while the rays in the latter are generally higher than in the former. But among the *Cupressineae Juniperus* has many more

rays than *Cupressus*, and *Thuja occidentalis* resembles in its relatively small number of rays the *Abietineae*. Among the *Taxineae*, *Taxus baccata*, with its large number of rays, resembles the *Cupressineae*, while *Gingko*, with its small number, approaches the *Abietineae*. The same is true of *Araucaria*. In view of the above as well as the individual fluctuations Essner emphasizes that rays "can not be used for identification of softwoods."

The use of the distribution of medullary rays in the identification of root-, stem-, and branch-wood is also impracticable. According to Fischer (8), who investigated these relations in *Pinus* and *Abies*, "the relation of the average number of rays in young branches and roots, to the age of the annual ring, is the same as in similar young stems." And he adds further, with reference to spruce, that in rays "no striking diagnostic indicator for stem-, root-, and branch-wood is to be found."

On the other hand, the situation with regard to the structural peculiarities of the rays seems to be different. According to Penhallow (23) "the medullary ray, in the various details of its structure, as presented radially and tangentially, comprises some of the most important features for diagnostic and taxonomic purposes." He discusses a number of generic and specific characters and points out that "the various structural features thus discussed in their relation to classification will show that no other portion of the stem possesses so many elements of importance as the medullary ray, which, in consequence, attains the highest value in this respect . . . and is of primary importance in the differentiation of groups, genera, and species." Record (24) also emphasizes the value of the structural peculiarities of medullary rays, in the identification of wood.

The same is true of some of the hardwoods. Thus Brush (3) says that "the pith rays are the only reliable means for identifying the woods of the sycamores." He gives the following table for their identification:

Identification of Sycamores by Pith Rays

Species	Specific Gravity	Width of Rays				Height of Rays		Ratio of Width to Height
		Minimum	Maximum	Average	Average Number of Cells	Average	Average Number of Cells	
Platanus occidentalis...	.5678	0.22mm	0.34mm	0.29mm	14	1.36mm	50	5:1
Platanus Wrightii......	.4736	0.10mm	0.22mm	0.16mm	8	1.84mm	84	12:1
Platanus racemosa......	.4880	0.04mm	0.20mm	0.09mm	5	2.36mm	107	26:1

Miss Griffin (21) investigated four species of *Acer* and reports as follows:

"No rays more than seven cells wide were found in the three species, bigleaf maple *(Accr macrophyllum)*, red maple *(Acer rubrum)*, and silver maple *(Acer saccharinum)*. In sugar maple *(Acer saccharum)* rays over seven cells were found, except in one specimen which was within two inches from the center of the tree. The maximum width of rays in sugar maple was 11 cells in one specimen.

"Within two inches of the center and up to four feet from the ground no rays were observed more than four cells wide in bigleaf maple, red maple, or silver maple, while in sugar maple the rays within the first two inches of radius were up to and including seven cells in width.

"The average number of whole rays one cell wide per circular tangential field 2.2 millimeters in diameter varied from 8.8 to 55.5 in the first three species mentioned and in sugar maple from 130.0 to 191.2. This made the total number of rays per unit area of tangential surface in sugar maple much greater than in any of the other three species.

"This shows that the greater width of rays, and the greater number of rays one cell wide, in sugar maple, are positive aids in distinguishing this species from the three others."

The above is in close agreement with Brown's (2) work on the maples, who gives additional ray characters useful in identification.

BIBLIOGRAPHY

1. Bailey, I. W. Depressed segments of oak stems. Bot. Gaz. 67:438-441. 1919.
2. Brown, R. L. Wood structure of elms, maples and oaks as a means of identifying species. Mich. Acad. Sc. 4th report. 1902. pp. 109-112.
3. Brush, Warren D. Distinguishing characteristics of the North American sycamore woods. Bot. Gaz. 64:480-496. 1917.
4. Chrysler, M. A. The medullary rays of *Cedrus*. Bot. Gaz. 59:387-96. 1915.
5. DeSmidt, W. J. Studies in the distribution and volume of the wood rays of slippery elm (*Ulmus fulva* Michx.). Jour. Forestry XX. 4:352-362. 1922.
6. Eames, A. J. On the origin of the broad ray in Quercus. Bot. Gaz. 49:161-7. 1910.
7. Essner, B. Ueber den diagnostischen Werth der Anzahl und Höhe der Markstrahlen bei den Coniferen. Abhandl. d. Naturf. Ges. zu Halle. XVI: 1-337. 1886.
8. Fischer, Hermann. Ein Beitrag zur vergleichenden Anatomie der Markstrahl gewebes und der jährlichen Zuwachszonen im Holzkörper von Stamm, Wurzel, und Aesten bei Pinus Abies L. Flora. 1885. pp. 263-278, 280-294, 302-309, 313-324.
9. Forsaith, C. C. Anatomical reduction in some Alpine plants. Ecology. I. 2:124-135. Apr., 1920.

10. ——— The morphology of wood in relation to brashness. Jour. Forestry XIX. 3. March, 1921.
11. Geiger, F. Anatomische Untersuchungen über die Jahresringbildung von Tectona grandis. Jahrb. Wiss. Bot. 55:522-607. 1915.
12. Groom, P. Evolution of annual ring and medullary rays in *Quercus*. Ann. Bot. 25:983-1003. 1911.
13. Hartig, R. Untersuchungen über die Entstehung und die Eigenschaften des Eichenholzes. Forstl. Naturwiss. Zeitschrift. III. No. 4. 1894.
14. ——— Holzuntersuchungen Altes und Neues. Berlin. 1901.
15. Jaccard, P. Uber die Verteilung der Markstrahlen bei den Coniferen. Berichte Deutsch. Bot. Gessel. 33:492-498. 1915.
16. ——— Neue Untersuchungen über die Ursachen des Dichtenwachstums der Baume. Naturwiss. Zeitsch. für Forst-und-Landwirtschaft. 13:355-359. 1915.
17. ——— Bois de tension et bois de compression dans les branches dorsiventrales de feuilles. Rev. Gen. Bot. 19:225-242. 1917. (Bot. Gaz. 65:487. 1918.)
18. Koehler, A., Dain, B. D., and Gerry, E. Cause and detection of brashness in wood. I. Commercial white ash and Sitka spruce. First Progress Report. Forest Products Laboratory. (Not published.)
19. Koehler, A., Smith, R. W., Jr., and Pillow, M. Y. Cause and detection of brashness in wood. II. Commercial white oak. Progress Report Project L20-5. Forest Products Laboratory. (Not published.)
20. Langdon, La Dema M. The ray system of *Quercus alba*. Bot. Gaz. 65:313-323. 1918.
21. Monthly Report, Wood Technology. November, 1925. pp. 1-2. (Not published.)
22. Myer, J. E. Ray volumes of the commercial woods of the United States and their significance. Jour. Forestry XX. 4:337-351. April, 1922.
23. Penhallow, D. P. A manual of North American Gymnosperms. Boston. 1907.
24. Record, S. J. Identification of the economic woods of the United States. New York. 1919.
25. Schmidt, E. Ein Beitrag zur Kentniss der secundären Markstrahlen. Ber. Deut. Bot. Ges. 7:143-151. 1889.
26. Simon, S. Der Bau des Holzkörpers sommer- und wintergrünen Gewachse und seine biologische Bedeutung. Berichte Deutsch. Bot. Gessel. 20:229-249. 1902.
27. Stone, Herbert. A text book of woods. London. 1921.
28. Teesdale, C. H. Relative resistance of various conifers to injection with creosote. Bul. 101. U. S. Dept. Agr. 1914.
29. Teesdale, C. H., and MacLean, J. D. Relative resistance of various hardwoods to injection with creosote. Bull. 606. U. S. Dept. of Agr. 1918.

THE PHILIPPINE MAHOGANY CASE

By Emanuel Fritz
University of California

The Federal Trade Commission in July 1926 issued a cease and desist order that forbids the several defendants in the "Philippine Mahogany" case from continuing to apply the terms "Philippine Mahogany" or "mahogany" to certain woods imported from the Philippine Islands. The decision is the first of its kind affecting lumber and is of much wider interest and application than the single class of woods specifically mentioned might indicate. It is regarded as a misbranding or false-labeling case and it forms a precedent which will doubtless influence decisions in other cases respecting the nomenclature of domestic woods. The decision is not final until the order is sustained by the Court of Appeals and therefore some dealers in Philippine hardwoods are continuing the use of the forbidden name. Some others however, have already changed to the designation "Philippine hardwoods" when all the Philippine woods are referred to, or the native names when specific species are involved.

The decision is not a unanimous one. Commissioner Humphrey dissented from the majority opinion in a rather lengthy and unnecessarily caustic minority opinion. The majority decision is based on the botanical classification of the tree producing the wood, while the dissenting opinion is based upon the appearance and utility of the wood alone and would permit the use of the term mahogany with a qualifying adjective to any wood having a mahogany-like appearance and filling the same uses as genuine mahogany. The case has performed a valuable service in emphasizing that to stick to botanical classification or nomenclature alone works a hardship in commerce, and that a too free use of established terms brings about confusion. The testimony presented is a very clear demonstration of the chasm existing between botanists and wood technologists and the lumber trade as to nomenclature and indicates that there is need for a get-together to establish the limits of the meaning and application of terms already current. There seems, to some, to be a need for a more flexible nomenclature which will describe the woods themselves without reference to the trees producing them, because after all it is the wood and not the tree that is the ultimate aim. This would be a very difficult terminology to work out and it may actually add more confusion instead of relieving it, and under it two

boards out of the same tree may have different names just as at present they might be designated as two different grades.

To the botanist the name mahogany brings up visions of the tree *Swietenia mahogani* or perhaps any species of this genus. The utility of the wood or even its appearance interests him but little. To the lumberman, furniture maker, and even furniture purchaser, the term mahogany may mean something entirely different. To them it means a wood of certain definite characteristics of color, figure, workability and stability, and to them the tree producing the wood is of little or no interest, it is, rather, a certain effect or a certain utility that they are after. The wood technologist is torn somewhat between two masters. He realizes clearly the significance and importance of the botanical basis of classification and of the scientific nomenclature, but, knowing also that one tree of a certain species may produce wood that is entirely different in color, figure and properties from the wood produced by another tree of that species he feels the need of some qualifying term to designate not only the tree source but the character of the wood. An excellent domestic example of this is our Douglas fir which produces wood more variable than any other commercial domestic softwood. Lumbermen of the Columbia River region have recognized the difference in the wood by giving it such names as "yellow fir" and "red fir," the one referring to the soft light colored fine-grained types of wood and the other to the stronger, and coarser red-colored types.

Too often it is a matter of business expediency rather than accuracy or clarity that dictates commercial nomenclature. Thus the names of well established and popular woods are borrowed and applied to new, unknown and untried woods to facilitate their introduction and sale. In this Philippine wood case the complaint should have been made ten years ago rather than now. Misnomers may often become fixed and a part of our vocabulary. This does not, however, correct the error or eliminate confusion. The designation "Philippine Mahogany" has been used so long that it has become well established, and it is really doubtful if any great harm would have resulted if the Federal Trade Commission had not decided against its use, provided of course that the two words are not separated, and that the designation is limited to but certain Philippine species. The confusion would continue, but would progressively decrease. This seems to have been the view of the dissenting commissioner. On the other hand there would have been real danger of trouble if the Commission had decided otherwise. First, because the unscrupulous dealer or factory may easily drop the word "Philippine" and speak

of and sell the wood simply as "mahogany." This has been the real complaint in the past—palming the wood off, not as "Philippine Mahogany" but as "mahogany," certainly a clear case of confusion if not of misrepresentation. Second, because a precedent would have been established which would have opened the door for anyone to plagiarize on the reputation of an old wood by adopting its name. Nothing could then stop the importer of a walnut-like wood from calling it, say "Amazon walnut," or, even "Philippine walnut," or, a wood slightly resembling oak, like Amapa, from calling it "Mexican oak." The decision is really a protection for the Philippine interests themselves and the lumber industry in general. Commissioner Humphrey says, that there is no public interest involved in this case, and that it is only a fight of the dealer of genuine mahogany against a new competitor. In this connection the writer is reminded of the letter head of a San Francisco dealer. On it were listed the woods specialized in by the company, and included was "Satinwood." The writer at once saw an opportunity to obtain some satinwood for his laboratory and wrote to the company which so advertised it. He was astonished to receive a reply stating that no sample would be sent because undoubtedly he already had a lot of this wood, because it was really white lauan!

There must be some stability to our nomenclature. Tampering with accepted meanings of certain terms is to invite confusion. Why should our Avocado be called "Alligator Pear" just because it is shaped like a pear. The first bite proves the difference. Or why should muskrat fur be called "Hudson's Bay Seal" because of a fancied resemblance to seal, or tupelo be called "Mexican birch" because of a slight resemblance to birch and because the wood is not in too high repute as tupelo. In the case of the Philippine woods untold confusion will result if their nomenclature is not settled upon early. The Philippines are rich in beautiful and useful woods; at the present time we import only about a half dozen species in large volumes. This small number will swell to many more as the peculiarities of the other woods are mastered and a place for them is found. Furthermore, to label some of them "Philippine Mahogany" while at the same time dealers of the real mahogany stencil theirs "genuine mahogany" is to call attention to a difference and invite suspicion, and stamp the Philippine product as a substitute. Few woods deserve less such a derogatory inference. The tanguile and red lauan, the two woods traded as "Philippine Mahogany" are beautiful woods capable sometimes of effects not possible even in the genuine mahogany, and furthermore they are cheaper and available

in higher average grades. They are however, not so similar to genuine mahogany as Commissioner Humphrey was led to believe they are. There is sufficient difference in structure and color to make their distinction from genuine mahogany easy, provided that the samples of each are typical and not selected from the small percentage that resembles and partakes of the characteristics of both. To say that Philippine woods could not be marketed readily under their native names is to belie actual cases. Companion woods like yacal, guijo, apitong and others are not generally designated "Philippine Mahogany," but carry their own native names. One manufacturer went so far as to adopt new native names for even the tanguile and lauan, and was successful in having the names widely adopted. The Philippine woods, once difficult to sell because unknown, untried and what is more important, not needed, are now well established, are well liked, we have learned how to handle and use them and there is often a bigger demand than the importers can readily satisfy. They could be marketed now under any kind of name because there is a genuine need and desire for them. It is therefore, a question if the Philippine hardwood dealers are injured much, if at all, by the adverse decision.

The comment of the trade press upon the decision is in general unfavorable. Some of the journals ridicule the decision unmercifully, and make capital of the dissenting opinion. One journal, the "Lumber World Review," prints Commissioner Humphrey's opinion in full under the caption "Philippine Mahogany's Doughty Defender; Snappy Minority Opinion Makes Good Reading." The "Timberman" produces an editorial under the title "Botany Triumphs" and one in another issue entitled "Botanical Purity." The "Timberman" fears that this attack on the use of the term "Philippine Mahogany" leaves the door open to similar attacks all along the line. It also calls attention to the lack of complaint against the use of the term by the public and makes it appear that the only one injured is the mahogany association. The editorial closes with "If botany continues to triumph we may yet see double page spreads in our national magazines advertising durable *Pseudotsuga taxifolia* and 40-year roofs of *Thuja plicata*." A probability that is of course ludicrous, the trade journals evidently seeing red when botany is mentioned. The dispute was actually a commercial one, not so much between public and producer but between producers of competitive woods, but the decision is based on botanical considerations almost wholly.

We should thank heaven for botanical names. We have in them at least some measure of assurance that a definite policy applies to their use. It is ridiculous to ask or imagine that anyone would adopt rather generally some of the lengthy and difficult botanical names in place of common names. No one has asked that. In this connection, however, it is interesting to note the increased use of botanical terms by lumbermen even in their advertising to avoid any possible misapprehension or confusion in the mind of the reader.

AIRPLANE SEED SOWING

By C. S. Judd
Forester, Hawaii

The practicability of sowing tree seeds from an airplane, in the effort to reestablish a forest cover on a burned area, was successfully demonstrated recently in Hawaii when over a quarter of a ton of seed of many tree species was sown broadcast over the Panaewa Forest Reserve situated four to seven miles from the town of Hilo on the island of Hawaii.

This is not the first time that this method of broadcasting seed has been employed in the territory of Hawaii for twice during the past four years, through the splendid cooperation of the commanding general, it has been possible to drop tree seed from army airplanes on denuded mountain slopes on the island of Oahu.

The necessity for using this method in the present instance was urgent because the fire had made its devastating way over about 700 acres of the roughest kind of country in this reserve, a billowing sea of crumbling lava, scanty of soil and replete with dangerous fissures and tumbling hillocks. To have attempted reforestation on this burn by hand sowing, would have required the painstaking and wearing efforts of many men over a long period. It was essential, moreover, to scatter the seed at the earliest practicable date after the burn so that the young trees might obtain a head start over the undesirable growth, such as weeds and grasses and the perniciously-creeping staghorn fern which is not only a fire menace but a notorious obstacle to natural reproduction.

The fire occurred in April and as soon as it was extinquished a request was made of the commanding general through the acting governor of Hawaii, for assistance by the assignment of an airplane from which the seed could be sown. The request was readily granted with the information that as soon as the new planes arrived from the mainland this cooperative work would be undertaken.

In the meantime a large amount of seed was collected, mainly on Oahu, and sent up to Assistant Forester L. W. Bryan, who was in charge of this project and who had suggested this method of sowing the seed on this burn. About 700 pounds of seed was assembled, stored in gunny sacks, and held in readiness for the flight.

On July 2, 1926, the plane assigned to this work arrived at noon

at Hilo from Honolulu, having covered the 200 miles of inter-island flight in approximately two hours. The planes fortunately were Loening amphibians, for the nearest landing field at South Point was over 70 miles away and inconveniently situated for the delivery of the seed. Since the plane could take off equally well from the water, the seed was readily hauled to Hilo harbor whence the flight was to start.

It was found that there was insufficient room in the plane for all the seed on hand, so three flights were made in which respectively six, seven, and eight gunny sacks of seed amounting in all to about 700 pounds were taken up and consigned to the air at an altitude of about 1,500 feet with the plane traveling at the rate of 110 miles per hour. It required from 30 to 45 minutes to throw out the seed. Mr. Bryan, who personally performed this labor, said that it was about the hardest kind of work he had done for, hampered by the parachute harness, it was most difficult to reach down and lift the bags to the gunwhale where they were opened and the seeds shot out in a stream. No large seeds such as *Barringtonia* or cocoanuts were taken up because of the injury they would cause to the plane "flippers."

Although the destination of the seed was readily distinguished by a railroad track on one side and a concrete road on the other, Lieut. Worthington, who piloted the amphibian plane, displayed remarkable skill in judging the wind direction and probable flight of the seed and gave the signal for Mr. Bryan to cast out the seed each time the plane was in the proper position for the released seed to fall on the burned area.

Seeds rather than seedlings were used; first, because the difficulty of packing in young trees over the rough ground would be too great, and second, it was believed that seeds would germinate and send their roots down into cracks and crevasses in this region of scanty soil better than would seedlings.

Seeds of about forty different species of trees, natives of India, Africa, Australia and other parts of the tropical world thus were sown in this project. Among these were the following: *Ficus rubiginosa* and *macrophylla, Spathodea campanulata, Melaleuca leucadendron, Erythrina indica, Albizzia lebbek, Samanea saman, Cedrela australis, Grevillea robusta, Casuarina glauca, Enterolobium cyclocarpum, Acacia arabica, Melia azedarach, Jacaranda ovalifolia, Cecropia peltata* and several kinds of palms.

Only time will tell whether the reforestation of this burned area by this method is successful but the results will be examined with interest.

REVIEWS

Our National Forests. By Richard H. D. Boerker. The Macmillan Co., Publishers, New York, 1926.

If any forester has grown discouraged with the progress of forestry in America, let him turn to the recently published second edition of "Our National Forests." This description of the work of the Forest Service on the National Forests was first published in 1918. As of that time, the book presents a readable as well as accurate picture of one phase of the work of the United States Forest Service, but unfortunately for the publishers the author dealt with a growing organization. Eight years have seen surprising progress and even our much berated Congress has passed legislation making for accelerated development.

The Introduction, and the first chapter which deals with the creation and organization of the National Forests, contain much of historical value. Every forest officer can afford to read and re-read the letter of the Secretary of Agriculture to the Forester, dated February 1, 1905, when the Forests were turned over to the Department of Agriculture. Here is set forth clearly the principle that "all the resources of the forest reserves are for *use,* and this use must be brought about in a thoroughly prompt and businesslike manner, under such restrictions only as will insure the permanence of these resources."

But, whereas on June 30, 1917, there were 147 National Forests with a total of 155,166,619 acres, on June 30, 1925, there were 159 National Forests and the area had increased to 158,395,056 acres. An organization which increases its holdings, and correspondingly its responsibilities by over 400,000 acres a year is growing more rapidly than most of us realize.

This increasing bulk has made necessary increased efforts toward protecting the Forests, toward making them more readily accessible, and toward the more satisfactory use of all of their resources. To this end there has been steady progress in the construction of roads, trails, telephone lines and other means of communication. In 1917 the Forest Service pointed with pride at the completion of over 3,000 miles of roads, but this seems dwarfed today beside more than 10,000 miles. True, some of these are the treacherous nine-foot roads, but with careful driving one can get safely over them, and some day they will be made a more satisfactory width.

Undue emphasis seems to have been given to direct seeding and broadcasting as a means of reforestation. Perhaps this method did not seem so much a failure in 1918, but more recently the entire trend of reforestation on National Forests has been with nursery grown stock. Planting has given way to sowing, and the number of acres reforested has increased from 135,500 in 1917 to 211,877 in 1925.

The number of Forest Experiment Stations has increased, and apparently so has the need for scientific experimental work. Increased use of National Forests as well as privately owned forests has brought to light enough things that foresters do not know to keep the increased staff of research workers busy for many years to come.

Fires continue to burn on National Forest land as well as elsewhere, but real progress is being made in their suppression. Stock are grazed, timber is sold, and the receipts mount up one year after another. Altogether it would seem that the ideal as set forth in 1905 by the Secretary of Agriculture is being more nearly approached with each year's progress.

It is unfortunate that the reissue of this book could not have taken into consideration the progress that has been made during these eight years. To have done so would have taken comparatively little effort on the part of the author, and would have brought up to date a book already recognized for its merit.

G. H. Collingwood.

Constructive Forestry for the Private Owner. By J. J. Crumley, Ph.D., Associate in Forestry, Ohio Experiment Station. Published by the Macmillan Co., N. Y., 1926.

We have books dealing with forestry in the white pine region of the East, some dealing with the forests of the far West and a few with the pine forests of the South, but here is one which centers attention upon the hardwood forests characteristic of the Ohio River Valley. The author has had a long and varied experience in this region and his discussion of the silviculture may be considered as a real contribution.

The private owner to whom the book is addressed is apparently the owner of farm woods in the Middle West. More specifically it appears throughout the book that the real audience which the author has in mind is college students. It is saved, however, by the very human manner in which the subjects are considered, from being pedantic or too academic. Practically the entire field of forestry is considered although emphasis is placed upon such phases as the physiology of trees

and the relation of trees to one another as they stand in a community and make up a forest. Improvement of existing stands of timber, the establishment of plantations, the harvesting of the mature crop and its utilization, as well as various phases which may be considered as the aesthetics of forestry, are all discussed. After each chapter is a list of questions dealing with the material previously considered. These questions may not interest the average reader, but they offer many helpful suggestions to the teacher and present themes to students for writing and for discussion.

Few publications give so much information on the establishment of forest plantations with broad-leaved trees and the maintenance of a farm nursery. Here the author seems to be dealing with a field with which he is especially experienced, and he has made some real contributions to the popular literature which deals with silviculture as applied to American hardwood forests.

The chapter on the preservative treatment of farm timbers and more particularly on the durability of these timbers in the soil, presents some independent observations such as form the basis for figures, some of which agree with those which foresters are accustomed to and others which challenge the more generally established ideas.

Logging and lumbering is handled from the point of view of a farmer confronted with problems of cutting hardwood timber under conditions typical of the Ohio River Valley. The information is practical and bears the stamp of one who has swung an axe and bossed a woods crew. In contrast to this, the discussion of forest mensuration presents little that is sufficiently practical to be applied by a farmer to his woods. Just why seven pages should be devoted to tables showing the analysis of 14 hardwood trees is difficult to understand. Surely these will be of little value to the average owner of farm woods who wishes to know how to estimate his timber, and a teacher would do better to have his students gather original material than to take it from a textbook. More simple suggestions for measuring his woods would be appreciated by the private owner and would be equally helpful to students.

From the forester's point of view, the book may be criticized because of the emphasis given to nut trees, particularly chestnut, which is so largely doomed as a factor in American forestry. The nut tree, however, is not to be scorned and particularly in the region with which the author is closely familiar, may be considered as an important addition to the woodland revenue. The book may also be criticized because of what appears to be rather careless editing. This is most apparent

in the titles which stand beneath the many illustrations. It is also to be found in the rather loose construction of English which characterizes much of the writing.

Every forester whose work carries him into the Middle West should be familiar with this book. The author lends a rather philosophical trend which makes it easy as well as interesting reading, and the observations are those of a trained mind which has culled information over many years.

G. H. C.

Yield, Stand, and Volume Tables for White Fir in the California Pine Region. By Francis X. Schumacher. Agricultural Experiment Station, Berkeley, Calif. Bulletin 407. Pp. 26. October, 1926.

Mr. Schumacher's article is a very timely one since there is beginning to appear a general awakening in forestry circles as to the importance of growth study and the construction of yield stand, and volume tables. The author presents the results of an intensive study of the growth of white fir, a species now much studied, and under investigation by private, state, and federal departments. The results appear sound as care was taken in compiling sufficient data to reach the results.

The field work consisted of making studies on 157 normally stocked even-aged sample plots. Their distribution over a very limited area brings out interesting facts. The study was limited to within a range of age classes of 40-150 years. The plots studied were not common since their even age was the result of natural reproduction of areas denuded by fire, and insect, and fungus attack. Normal even-aged stands in this sense means the maximum growth making full use of climate and site factors. The age determinations were made by increment borings. Although not a generally accepted fact the site qualities here were classified according to the height of the average dominant white fir at 50 years of age. The author deviates from the standard classification of the range of the species into 3-5 sites by giving each plot an index number corresponding to the average dominant height of white fir attained in 50 years.

These were plotted on cross section paper and a height curve established. A form curve was used and the increase of height of the average dominant white fir through 10 foot intervals at 50 years was determined, thus defining site classes. Through these 10 foot intervals white fir yield tables were constructed for each site index from 90 feet at 50 years to 30 feet at 50 years. These yield tables

show age, number of trees per acre, average height, average D. B. H., basal area per acre, volume per acre, average annual growth per acre and number of plots. The assumption is made that although the stands are never fully stocked after a logging operation in number of trees they are normal in yield. This can hardly be accepted as true in all cases of predicting yield.

One interesting fact is the exceptionally slow growth of white fir up to an age of 30 years and from there on there is a marked acceleration of growth up to 90 years. Here presents itself a problem in selecting the right rotation.

The basal area of the plots per acre were found to be independent of plot area, and thus care was exercised in getting representative plots. Nine plots were rejected because they over ran 150 years. The basal area of each plot was plotted and a curve made; all those plots which deviated from the curve with a probable error of more than plus or minus 36 per cent were rejected.

The relation of the height growth of white fir with associate species show interesting results. Western yellow pine and red fir make practically the same growth, but with douglas fir and sugar pine another classification is necessary.

In the construction of stand tables the plots were sorted by 10 foot site classes and the distribution of trees per acre by diameter classes were computed in cumulative per cent. The values of each age class were plotted and curved and the tables thus determined. The volume tables were made from measurements taken from 600 trees made by the U. S. Forest Service.

Three outstanding impressions mark this bulletin: (1) The classification of site qualities by plot site index number based on average height of dominant trees. (2) Necessity and care in securing right rotation for this species due to early slow growth in first 30 years, and its susceptibilty to damages of fire, insect and fungus. (3) Application of yield tables so constructed to stands of California and other places as compared to the standard construction of yield tables.

A. H. Wilkins

Biology and Control of the White Pine Weevil ("Pissodes strobi" Peck.) By S. A. Graham, Bul. 449, Cornell Agr. Exp. Sta., June, 1926.

Probably no forest insect has received such a prolonged length of study by a long list of entomologists as that given to the white pine weevil. The continual increase in areas of second-growth white pine resulting from both natural and artificial regeneration and the result-

ing poor quality of much of it has brought about this great interest. Even at the present writing several agencies are at work on different phases of the weevil problem, and it truly is a problem. Graham's paper again adds to our knowledge of the weevil and again emphasizes previously published facts. The paper sets forth the results of a long careful study made both in New York state and in Minnesota and admirably brings up to date our knowledge of the weevil.

Graham states that it is estimated that from 70 to 90 per cent of all the white pines in New York and New England have been weeviled before they have reached the age of fifteen years. He emphasizes the fact that weevil infestation increases rapidly, reaching the maximum when the trees are from twelve to eighteen years of age, and that the most thrifty and rapidly growing trees in the stand are the most susceptible. Knowledge of the life history has been added to, in that Graham found that the adult weevils hibernate in the litter beneath the infested trees. There still seems to be some question as to how the beetles reach the tops of the trees. Although several observers have seen them in flight, Graham believes that the majority of them crawl up the trunks. Control of the weevil rightly receives considerable space. Here three methods are particularly emphasized. (1.) Pruning of infested leaders early in July and placing them in receptacles covered with fine wire that will allow the parasites to escape, but hold in the weevils. The alternative being to burn the weeviled tops. (2.) The use of silvicultural methods that will provide shade during the susceptible period such as inter-planting amongst hardwoods. (3.) The maintenance of a density of at least 1,200 trees per acre through the early years of rotation aids very materially in lessening the resulting injury in pure plantations where it is not possible to use the shelterwood system.

H. B. Peirson

CURRENT LITERATURE

Compiled by Helen E. Stockbridge, Librarian, U. S. Forest Service

LIST FOR OCTOBER, 1926

(Books and periodical articles indexed in library of U. S. Forest Service)

Forestry as a Whole

Bunker, P. S. Forestry: what it is. 16 p. illus. Montgomery, Ala., 1926. (Alabama—State commission of forestry. Bulletin no. 1.)

Proceedings and reports of associations, forest officers, etc.

British Honduras—Forest dept. Annual report for the year ended 31st March, 1926. 24 p. Belize, 1926.

Great Britain—Commissioners of crown lands. The hundred and fourth report, dated 29th June, 1926. 36 p. London, 1926.

New Zealand—State forest service. Annual report of the director of forestry for the year ended 31st March, 1926. 39 p. illus. Wellington, N. Z., 1926.

Ontario—Dept. of lands and forests. Report for the year ending 31st October, 1925. 109 p. Toronto, 1926.

Forest History

Stahl, R. M. The Ballinger-Pinchot controversy. 138 p. Northampton, Mass., 1926. (Smith college studies in history, vol. 11, no. 2.)

Forest Education

University of Montana—School of forestry. Announcements for 1926-1927. 15 p. Missoula, Mont., 1926.

Forest Legislation

United States—Dept. of agriculture—Forest service. Law enforcement on national forests, California district, rev. ed. 89 p. Wash., D. C., 1926.

Forest Description

Poland—Ministère de l'agriculture et des domaines de l'etât. Les forêts en Pologne. 75 p. illus., maps. Varsovie, 1926.

Robertson, C. C. The trees of extra-tropical Australia. 265 p. pl., maps. Cape Town, S. Africa, Govt. printer, 1926.

Forest Botany

Maiden, J. H. A critical revision of the genus Eucalyptus, pt. 66. 76 p. pl. Sydney, Govt. printer, 1926.

Mattoon, W. R. and Hawes, A. F. Forest trees of Connecticut: a pocket manual, rev. ed. 52 p. illus. Hartford, Conn., State park and forest commission, 1926.

Société dendrologique de France. Bulletin no. 59. 25 p. Paris, 1926.

Forest Investigations

Busse and Jaehn. Wachsraum und zuwachs (Wermsdorfer fichtenkulturversuch). 83 p. diagrs. Berlin, 1925. (Tharandt—Sächsische forstliche versuchsanstalt. Mitteilungen, band 2, heft 6.)

Silvical Studies of Species

Smitt, A. Vestnorsk furu. 28 p. pl., diagrs. Bergen, 1926. (Norway—Vestlandets forstlige forsoksstation. Meddelelse, vol. 3, no. 3.)

Silviculture

Planting and nursery practice

Callward, F. M. Planting forest trees on the farm. 4 p. illus. Burlington, 1926. (University of Vermont—College of agriculture—Agricultural extension service. Circular no. 37.)

Howard, S. H. Notes on artificial regeneration in north India. 37 p. pl. Calcutta, 1926. (Indian forest records, vol. 12, pt. 9.)

Forest Protection

Insects

Fleutiaux, E. and Gardner, J. C. M. On some Indian Coleoptera, pts. 1-2. 10 p. pl. Calcutta, 1926. (Indian forest records, vol. 12, pt. 10.)

Diseases

Hagem, O. Schütteskader paa furuen *(Pinus silvestris.)* 133 p. Bergen, 1926.

(Norway—Vestlandets forstlige forsoksstation. Meddelelse, vol. 3, no. 2.)

Fire

Quebec—Dept. of lands and forests—Forest protection service. Report on the protection of the forests during the year 1925. 63 p. pl., tables, diagrs. Quebec, 1926.

Forest Mensuration

Volume and yield tables

Smitt, A. Bidrag til bedommelse av eides kubiktabel for furu. 24 p. tables, diagrs. Bergen, 1926. (Norway—Vestlandets forstlige forsoksstation. Meddelelse, vol. 3, no. 4.)

Forest Management

Working plans

Stoate, T. N. Working plan no. 1: Mundaring working circle. 32 p. illus. Perth, 1926. (Western Australia—Forests dept. Bulletin no. 37.)

Forest Valuation and Finance

Hiley, W. E. The financial return from the cultivation of Scots and Corsican pines. 32 p. diagr. Oxford, Eng., 1926. (Oxford university—Imperial forestry institute. Oxford forestry memoirs no. 6.)

Forest Economics

Statistics

International institute of agriculture—Bureau of statistics. Forests and forestry: statistical and other information for certain countries. 425 p. Rome, 1925.

Forest Administration

New Zealand—State forest service. Forestry in New Zealand. 16 p. map. Wellington, 1925. (Circular no. 22.)

Sabroe, A. S. Forestry in Denmark: a guide to foreigners. 64 p. Copenhagen, Danish forestry society, 1926.

Western Australia—Forests dept. The foresters' manual, pt. 1. 91 p. diagrs. Perth, 1926.

National and state forests

Ross, R. M. Vermont's state forests and outstanding forest attractions. 8 p. illus., map. Montpelier, 1926. (Vermont—Forest service. Publication no. 31.)

United States—Dept. of agriculture—Forest service. National forest areas, June 30, 1926. 7 p. Wash., D. C., 1926.

Forest Utilization

Lumber industry

Betts, A. W. Marketing problems of tropical hardwood exploitation. 10 p. illus. Wash., D. C., 1926. (Pan American union. Forestry series no. 12.)

Wood Technology

Beversluis, J. R. De micrografische identificatie van hout. 132 p. tables Wageningen, H. Veenman & zonen, 1925.

Brown, H. P. An elementary manual on Indian wood technology. 121 p. illus., pl. Calcutta, Central pub. branch, 1925.

Entrican, A. R. The properties and uses of kohekohe (Dysoxylum spectabile). 4 p. Wellington, 1926. (New Zealand—State forest service—Branch of forest products. Leaflet no. 2.)

Entrican, A. R. The properties and uses of pukatea (Laurelia novae-zelandiae). 4 p. Wellington, 1926. (New Zealand—State forest service—Branch of forest products. Leaflet no. 1.)

Hawley, L. F. and Wise, L. E. The chemistry of wood. 334 p. diagrs. N. Y., Chemical catalogue co., inc., 1926.

Auxiliary Subjects

Parks

Canada—Dept. of the interior—Canadian national parks branch. Report for the year ending Mar. 31, 1925. 34 p. illus. Ottawa, 1926.

Periodical Articles

Trade journals and commerce reports

American lumberman, Sept. 25, 1926.—Hardwood markets and prospects in Illinois, p. 50-52; The future of American hardwoods, by V. H. Sonderegger, p. 63-65; Tells of wood utilization in Europe, by G. M. Hunt, p. 70.

American lumberman, Oct. 2, 1926.—Wood snow fences keep roads clear, p. 47.

American lumberman, Oct. 16, 1926.—Relation of size of tree to logging costs, stumpage values and profits, by W. W. Ashe, p. 73-4; Empire state forest products association annual and wood utilization conference, p. 76-7.

American lumberman, Oct. 23, 1926.—Characteristic properties and uses of softwoods, by L. S. Case, p. 1, 57; Open forestry field station, p. 39; Annual small sawmill demonstration, p. 48-9; What about small dimension stock, by W. A. Babbitt, p. 50.

Barrel and box, Oct., 1926.—Sectional crate construction, by H. N. Knowlton, p. 47-9.

Chicago lumberman, Oct., 1926.—Forests are nation's only perpetual natural resource, by E. A. Thornton, p. 17; Paper plants may operate pulp mills in forested regions, by H. P. Baker, p. 28.

Cross tie bulletin, Oct., 1926.—Why care in the selection of cross ties, by J. Foley, p. 10-18.

Hardwood record, Sept. 25, 1926.—The theory and achievement of national grades, by C. N. Perrin, p. 40-1; On sawmills, past, present, future, by G. F. Cosgrove, p. 46-50, 56.

Hardwood record, Oct. 10, 1926.—Historical aspects of the tropical American forests, by C. D. Mell, p. 26, 28, 48.

Hardwood record, Oct. 25, 1926.—Ash the versatile hardwood is indispensable to many industries, p. 13, 18, 22, 24-5.

Lumber manufacturer and dealer, Oct. 15, 1926.—Where the public "sees and believes" how the industry saves wood, p. 23-4; Wood block paving, target of criticism as rains play havoc with streets, by J. E. Gatewood, p. 30a-b.

Lumber trade journal, Oct. 1, 1926.—Texas forest fire prevention work, 1926, by H. J. Eberly, p. 11.

New York lumber trade journal, Oct. 15, 1926.—Hardwood reforesting in Louisiana, by J. R. Thistlethwaite, p. 36-7.

Paper mill and wood pulp news, Sept. 18, 1926.—A semi-chemical pulping process, by J. D. Rue and others, p. 10, 12, 39-40; The rod mill in the pulp and paper industry, by J. D. Rue and S. E. Wells, p. 14, 16.

Southern lumberman, Oct. 2, 1926.—Natural reproduction alone unable to reforest nation's cut-over areas, p. 34.

Southern lumberman, Oct. 16, 1926.—Estimating Appalachian hardwoods, by R. C. Staebner, p. 32-3.

Southern lumberman, Oct. 23, 1926.—Abnormally adverse conditions of Japanese lumber market, by E. Arikawa, p. 48, 50.

Timber trades journal, Sept. 18, 1926.—New log-piling machine, p. 848.

Timber trades journal, Oct. 9, 1926.—The supply and production of marketable timber in Great Britain, by L. S. Wood, p. 1087-94.

U. S. commerce report, Sept. 27, 1926.—British lumber situation, by A. E. Boadle, p. 809.

U. S. commerce report, Oct. 4, 1926.—Record production in Norwegian pulp and paper industries, by S. B. Jacobson, p. 41-2.

U. S. commerce report, Oct. 11, 1926.—United States lumber exports, January-August, by A. Marlowe, p. 101-2.

U. S. commerce report, Oct. 18, 1926.—Finland's paper and pulp industries during 1925, by J. F. McGurk, p. 150-2; Eight months' lumber imports into United States, by A. Marlowe, p. 167-8.

West Coast lumberman, Oct. 1, 1926.—Cause and prevention of decay in wood construction, by C. J. Hogue, p. 46, 48-9.

West Coast lumberman, Oct. 15, 1926.—Wood flour: its manufacture and principal uses, by H. H. Steidle, p. 62, 66.

Forest journals

Allgemeine forst- und jagdzeitung, Sept., 1926.—Ueber die waldbauliche bedeutung der Vanselowschen untersuchungen, hinsichtlich wahl der holzart, by Weber, p. 305-12; Gedanken über die organisation der badischen staatsforstverwaltung, by Abetz, p. 325-33; Forstliches aus Ungarn, by J. Roth, p. 333-5.

American forests and forest life, Oct., 1926.—Legislative needs in forestry, by G. D. Pratt, p. 603-4; A plan to co-ordinate conservation interests, by R. C. Ringland, p. 613-15.

American forests and forest life, Nov., 1926.—A view of the woods from within, by W. M. Compton, p. 643-6, 690; New York, port of fancy hardwoods, by E. C. M. Richards, p. 649-54; What will we do for pencils, by R. K. Helphenstine, Jr., p. 654; The forest's enemies in the sea, by G. M. Hunt, p. 655-8, 682; The western myrtle, by M. Wharton, p. 659-60; The autobiography of trees, by D. T. MacDougal, p. 661; Ancient ideas in modern woodwork, by H. Maxwell, p. 663-7, 680; Logs and leather: the chestnut from tree to tannin, by M. A. Mattoon, p. 669-71; Caterpillar tractors in the logging woods, by R. W. Ayres, p. 672-5; Giving the lookout man a chance, p. 678; Co-operators confer with President Coolidge to cut down forest fire loss, p. 679-80; "Chug-chug," p. 687; Who's who among our officers: William B. Greeley, director, p. 688; Last women lookouts in Forest service, p. 701.

Australian forestry journal, July, 1926.—Tree planting and the science of forestry, by R. D. Hay, p. 173-9; Forest insects no. 22: the leaf case moth, by W. W. Froggatt, p. 179-83; The tuart bud weevil, by L. J. Newman, p. 191-5.

Australian forestry journal, Aug., 1926.—The forest and the paper industry, by D. Avery, p. 201-4; Forest insects no. 23: powder-post beetles of the family Lyctidae, by W. W. Froggatt, p. 204-10; Some remarkable trees of Western Australia, p. 211-14; White ants injurious to wooden structures, and methods of preventing their ravages, by M. Oshima, p. 220-4.

Forest leaves, Oct., 1926.—What value is being protected from forest fire in Pennsylvania, by G. H. Wirt, p. 163; Salvaging the chestnut tree, p. 163-4; Farm forestry, by J. A. Ferguson, p. 165-7; Seeing the forests of Europe, by J. S. Illick, p. 168-70; The lumber industry of Bedford county, by W. L. Byers, p. 170-1; Pennsylvania's forests and game, by F. G. McIntosh, p. 171-4.

Forest patrolman, Sept. 15, 1926.—Possible versus actual yields, by T. T. Munger, p. 2; Three seasons of the fire weather service, by G. W. Alexander, p. 2; European forestry: can it teach us anything, by G. W. Peavy, p. 3.

Forstarchiv, Aug. 15, 1926.—Einfluss des walzens auf kiefernsaaten, by H. H. Hilf, p. 246-8.

Forstarchiv, Sept. 1, 1926.—Ueber das verhalten des baummassenzuwachses zu einer seiner komponenten, by W. Tischendorf, p. 257-60; Beiträge zur intensivierung des holzaufbereitungsbetriebes, by Stadler, p. 260-1.

Forstarchiv, Sept. 15, 1926.—Die bekämpfung des eichenwicklers in den Oberförstereien Bischofswald und Haste, by H. Krieg, p. 273-6.

Forstwissenschaftliches centralblatt, Sept. 15, 1926.—Wuchsgesetze von Pinus silvestris, by W. Tischendorf, p. 652-62; Humuszehrer, by K. Volger, p. 663-5.

Illustrated Canadian forest and outdoors, Oct., 1926.—Forest carelessness, by E. L. Chicanot, p. 553-4; Beating erosion by willow planting, p. 558; Fall forest fires, by G. M. Dallyn, p. 562; Seeds for future forests, by A. H. Richardson, p. 563-4; Beautifying prairie homes, by G. Watt, p. 565-6; Mr. Ranger, here's how, by C. J. Broderick, p. 570-2; An eyrie look-out in Algonquin park, by G. A. Mackie, p. 572; The trees on Toronto Island, by C. M. Campbell, p. 573-4; Fair play vs. free play, by T. H. Wilkinson, p. 575-6; A forest protection exhibition in British Columbia, p. 578-9; The autobiography of a Douglas fir, by L. H. Christie, p. 588-90.

Indian forester, Sept., 1926.—The world's forestry congress of 1926, by E. P. Stebbing, p. 437-59; An attempt to analyze the effects of grazing on forest conservation in the Central Provinces, by C. M. Harlow, p. 459-65.

Indian forester, Oct., 1926.—An extraordinary bamboo coupe in the Lansdowne division, U. P., by F. W. Champion, p. 497-502; The constructive properties of fire in chil (Pinus longifolia) forests, by E. A. Greswell, p. 502-5; Conversion to the shelterwood system in the sal forests of the U. P., by M. Hakimuddin, p. 505-8; Cyprus today: farmers and forests, p. 530-5; Successive measurements of sample plots, by M. D. Chaturvedi, p. 545-9.

Journal forestier suisse, Sept.-Oct., 1926.—L'expérience saxonne, ou un demi-siècle d'application de l'exploitabilité financière, by H. Biolley, p. 189-96; Les dunes de Mogador et leur fixation, by P. Jaccard, p. 196-202; Contribution à l'étude des moyens de rajeunissement de l'épicéa, by H. Muller, p. 202-3; Un cyclone dans le Jura, by Lozoron, p. 208-10; Des années à graines chez l'épicéa, by J. P. C., p. 211-14.

Journal of forestry, Oct., 1926.—Wanted: dirt foresters, by W. Shepard, p. 623-6; On the space arrangement of trees and root competition, by V. T. Aaltonen, p. 627-44; The white pine blister rust in Germany, by P. Spaulding, p. 645-52; Methods of preparing volume and yield tables: report of the Committee on standardization of volume and yield tables, p. 653-66; The mission of forest research, by S. T. Dana, p. 667-72; A forest type classification for the southern Appalachian mountains and the adjacent plateau and coastal plain regions, p. 673-84; Weather injury to terminal buds of Scotch pine and other conifers, by H. C. Belyea, and H. J. MacAloney, p. 685-90; Micrometer slide adapted to core measuring, by J. E. Patterson, p. 691-3; Who will lead forest research, by C. A. Schenck, p. 724-5; A noteworthy event, by E. W. Tinker, p. 725-6; Fires and game, by A. Leopold, p. 726-8; Collection of long-leaf pine seed in Texas, by J. W. Toumey, p. 728-9.

Revue des eaux et forêts, Sept., 1926.—Les réformations successives de la forêt de Rambouillet, by A. Granger, p. 452-63.

Schweizerische zeitschrift für forstwesen, Sept., 1926.—Verbauung, entwässerungen und aufforstungen im Nollagebiet, by A. Henne, p. 209-23; Internationaler forstkongress in Rom, 29. April bis 5. Mai 1926, by H. Knuchel, p. 223-31.

Tree talk, autumn number, 1926.—Mushrooms on trees, by H. M. Fitzpatrick, p. 4-6; White pine and white pine blister rust, by H. H. York, p. 8-10; Men and trees, by F. A. Bartlett, p. 16-18; Indian trail trees, by W. M. Bangall, p. 20-3; The care of locust trees, by C. F. Greeves-Carpenter, p. 28-9.

University of Washington, Forest club quarterly, June, 1926.—Forestry principles for the Pacific northwest, by E. J. Hanzlik, p. 10-13; The economics of lumber utilization, by A. H. Landram, p. 14-32; Caterpillar tractor logging, by C. Whipple, p. 33-6; Reforestation for Cowlitz county, by J. B. Woods, p. 37-8; The practice of forestry in western yellow pine, by J. W. Girard, p. 39-43.

Yale forest school news, Oct., 1926.—Filibert Roth, by H. H. Chapman, p. 67-8; The world forestry congress, by F. F. Moon, p. 69-70.

Zeitschrift für forst- und jagdwesen, July, 1926.—Vergleichender anbauversuch mit einheimischen holzarten verschiedener herkunft 1878 bis 1925, by M. Kienitz, p. 397-415; Aus der geschichte der Oberförsterei Böddeken, by Wegener, p. 415-30; Die untersuchungen Professor Dr. Wiedemann's zur kieferndauerwaldfrage, by Dengler, p. 431-49.

Zeitschrift für forst- und jagdwesen, Aug., 1926.—Studien über einige chemische eigenschaften der profile von waldböden, by A. Nemec and K. Kvapil, p. 461-81; Aktuelle verwaltungsfragen der Preussischen forstverwaltung, by Köster, p. 489-99.

Zeitschrift für forst- und jagdwesen, Sept., 1926.—Die bestandesderbholzermittlung, by Lent, p. 554-64.

Miscellaneous periodicals

American game, July, 1926.—Combining timber and game production, by D. E. Lauderburn, p. 50-1, 61.

Building age and national builder, Sept., 1926.—Present practice of lumber grading, by E. M. Davis, p. 148-50.

Bulletin of the Pan American union, Oct., 1926.—The flora of Venezuela, by P. C. Standley, p. 978-90; Some reasons why tropical American timber operations have failed, by C. D. Mell, p. 1006-11.

Gardeners' chronicle, Oct. 9, 1926.—Neglect of British forestry, by A. D. Webster, p. 288.

House and garden, Sept., 1926.—Hedges and the plants to make them, by E. H. Wilson, p. 92-3, 172, 174, 178.

Industrial and engineering chemistry, Oct., 1926.—The future trend of cellulose chemistry, by G. J. Esselen, Jr., p. 1031-4; The painting of treated wood, by M. E. Dunlap, p. 1091.

Journal of geography, Oct., 1926.—The cork oak, by W. O. Blanchard, p. 241-9.

Journal of the New York botanical garden, July, 1926.—Why are chestnuts self-fruitless, by A. B. Stout, p. 154-8.

National wool grower, Oct., 1926.—Domestic stock vs. game, by J. H. Rutledge, p. 25-6.

Paint, oil and chemical review, July 8, 1926.—Car bracing and how to use it, by R. P. A. Johnson, p. 18.

Proceedings of the American society of civil engineers, Sept., 1926.—Unit stresses in timber, by J. A. Newlin, p. 1436-43.

Transmitter, Oct., 1926.—Telephones in the forest, by E. F. Hill, p. 3-10.

U. S. Dept. of agriculture. Journal of agricultural research, Oct. 1, 1926.—Age classes of western white pine planting stock in relation to aspect of planting site in northern Idaho, by W. G. Wahlenberg, p. 611-19.

U. S. Dept. of agriculture. Monthly weather review, July, 1926.—Lightning and forest fires in the northern Rocky mountain region, by H. T. Gisborne, p. 281-6.

U. S. Dept. of agriculture. Official record, Oct. 6, 1926.—Para rubber tree is found at Palm Beach, p. 1-2, 8.

NOTES

Who Wants Dirt Foresters?

Editor:

Shepard's article in the October number contains food for thought. To begin with—the title, Wanted: Dirt Foresters. Yes, but let us ask ourselves frankly who really wants them? This question is raised not in criticism of Shepard's excellent article, but to try to build a little constructive criticism on the framework he has started.

I can think of two answers to the question raised—who wants them? First, the foresters who want the jobs; second, the forest situation generally.

As to the first, there are more foresters doing dirt forestry than may be supposed. The big field in private land management is operating. I know of no better place for a forester to begin than as a camp clerk, timekeeper, or scaler. He might of course begin as a chopper, teamster, or the like, but it doesn't take long to learn all of these trades that are necessary for professional success. As a camp clerk, or the like, he has opportunity to learn facts and figures, and to observe conditions, far more rapidly than in manual labor, and while I appreciate the value of the manual labor, enough of this is enough.

The forester who by experience, and by reputation for good judgment, has won the confidence of the land owners, can hope for such a position of trust as Mr. Shepard has suggested he should have.

From time to time, land owners find the need of employing foresters, or of handling lands for sustained yield or the like. Such situations arise principally through the special needs of certain industries, or the needs of specific tracts of land, and afford employment for foresters. Yet outside of opportunities of this kind, what field is there open to the private forester in land management?

Other than timber estimating, and the like, which is really a branch of professional engineering, a consulting forester is free to undertake any phase of private land management. Yet, except as he may be employed on a retainer or fee basis by some land owner, what can he do? He can buy land and operate it. To do this successfully, he must first buy as cheaply as possible, thereby opposing the teachings of state foresters and extension men who very properly try to assist the farmer or land owner in getting as much for his stumpage as possible. He must next cut anything salable from the land, the only limitation to this procedure being sensible speculation as to whether

anything left standing will enable him to make more from the whole transaction through future sales of land or stumpage.

This doesn't sound much like forest management as taught, which is another way of saying that we as a profession are up against economic conditions, and is answering the second part of the question.

It must be remembered, that all tracts of land are already being managed or mismanaged in some fashion. The forester can not hope to supplant present management unless in the judgment of the owners he can do it better. The trouble with the profession is that we have looked too much for chances to make spectacular revolutions. It is not intended to minimize too much the importance of radical or spectacular advances. I can think of a number of opportunities for radical advance in private forestry, but these await the right time and conditions, and a genius to guide them. They are poor bets for the average forester, by which to earn his living year after year.

It takes a long time to grow a tree. It can't be done by revolutions, but only by steady, patient advance year by year. Private lands are already being handled with a view to revenue. Can forestry, with due consideration of time, interest charges, and cost of supervision, increase revenue? Can the forester improve on the revenue earning capacity of existing management?

The work of successful land management consists of boundary surveys, estimates; planning, supervision, and inspecting logging operations; protection against fire and the like, and trespass. It may involve problems of considerable difficulty, such as knowledge of markets, legal disputes, etc., but most of it is not spectacular and in most cases involves but little silviculture or theoretical management. What the forester can do, is to bring the aid of his highly trained mind to problems beyond the ability of the ordinary woods boss, but the more he has of the fundamental experience which the woods boss has been a lifetime in acquiring, the better.

A number of years ago, the profession was strongly of the opinion that the way to secure the practice of forestry on private lands was to get foresters into the lumber industry. This enthusiasm has somewhat cooled, but the process has continued nevertheless. The enthusiasm has cooled because it has been felt somewhat by the more theoretical members of the profession that these forester-lumbermen had sold themselves out to the lumber industry, and weren't helping much, after all, to bring about the practice of forestry.

A certain tract of land is handled ordinarily in a certain way, and it is pretty commonly to be observed that after all, if a forester has been concerned in the management, he couldn't have done much differently in silviculture and general policy. Dirt foresters must practice dirt forestry.

All this is not saying that no advance is possible. The successful private forester is seeking constantly for new fields of activity, and it is important to note that being to some extent in competition with the woods boss, he is seeking particularly for fields in which the woods boss can not compete—in other words, in the more technical branches of forestry.

The nation, including land-owners, is "sold" to forestry generally. What we are up against is economic conditions. With a growth of only two or three per cent in the Northeast, and with no important increase in stumpage values, there is at present no incentive to radical changes in forest management, and will not be until the practical exhaustion of the competing virgin Canadian stands can be definitely figured. The large Northwest supply controls the softwood market of the country in the same way. Yet there is nevertheless a steady improvement in forest land management. In so far as forestry can work into this situation for efficient service, it is wanted, but outside of this, it is not wanted or necessary.

A word as to the excess of talk in forestry. Much of the talk is indispensable. Talk is fundamental for preventive work in fire protection, for example. I knew, also, by the way, of a tract of land of about three townships, inherited by a family of seven old maids and old bachelors. Some were not on speaking terms. Due to lack of agreement, no cutting had been done for years, and fire and insects had depleted the stand fully one-half. Here might be an opportunity in forest management for the good talker.

There are, however, several misconceptions in forestry propaganda that weigh against confidence in the profession, and the sooner these are done away with the better. These misconceptions of the situation comprise lack of information or disregard of costs, undue optimism as to future stumpage values, the waste land theory, use of too low interest rates, and propositions to build silviculture and management on a shaky foundation of insufficient protection against fire. By the waste land theory, I mean the idea that any unproductive land is a burden to the community. Idle land is not a burden unless the probable yields from its use will exceed the cost of timber production. Forestry should

begin on the best forest land, not the worst. As about six per cent is commonly figured on loans, and as interest becomes available annually, this rate should be used compounded. It is a waste of money to employ it at four per cent, when higher rates can be obtained safely, other things equal. This applies to private funds, and also with some qualifications to public funds, which are derived from private tax-payers. Business returns are in fact frequently much more than six per cent.

To sum up: There is plenty of chance in private work for the forester with experience and judgment, but don't expect him to revolutionize forest land management. Economic conditions control the progress of applied forestry.

It may be noted also that concentration of ownership and acquisition of lands by certain industries, in order to control their supply of raw material, afford the most common opportunities for the practice of forestry.

P. T. Coolidge, *Forest Engineer.*

An Aid in Establishing Sand Flat Tests

Sixteen thousand seeds counted out in lots of one hundred, check counted, sown in sand flat drills, covered a measured depth, labeled, and watered, by two men in two days and a half—this is the record the writers established with the aid of a home-made seeder in recent germination tests at the Southern Forest Experiment Station. The simplicity of the seeder and the speed and accuracy it insures in sand flat work, may make it of interest to other foresters having large-scale sand flat tests to perform.

The sand flats were ten and a half inches square inside. The seeder was made of a four by fourteen inch strip of galvanized iron, in which a ten inch slit was cut three-quarters of an inch from one edge. A short slit was cut at right angles to the long slit at each end, so that the metal could be bent down to form a trough-like opening ten inches long, three-eighths of an inch wide at the top, and a quarter of an inch wide at the bottom. The edge opposite this opening was bent up to form a low backstop, and one end of the strip was bent down to fit against the side of the sand flat and act as a guide in placing the seeder over the drills.

Laborious handling of individual seeds with forceps was eliminated. The seeder was set on the flat, with the opening over a drill. The seeds, already counted once, were scattered on the top of the seeder

between the backstop and the opening. The check count was made as the seeds were pushed into line along the edge of the opening, and a single stroke of a straight-edge tumbled them all into the drill.

PHILIP C. WAKELY and R. A. CHAPMAN,
Southern Forest Experiment Station.

Frost Killed Oak

Will a single late freeze kill mature deciduous trees indigenous to our Appalachian forest region? It is the opinion of the writer that such a thing actually does occur, it being the exception however rather than the rule.

During the past summer the men engaged in forest entomology work at the Bent Creek Field Laboratory near Asheville, North Carolina, were often called upon to identify the causes of the death of dead and infested timber. It was in response to one of these requests that the writer visited a tract of timber in Bland County, Virginia, which contained approximately three million feet of dead white oak. The estimate had been made previous to a sale which was under way at the time. The tract was gone over together with one of the agents of the lumber company and the areas where only green timber occurred were visited as well as areas where the trees were affected and conditions on the two were compared.

After examining the dead timber, noting the conditions under which the dead oak occurred, discussing the situation with some of the inhabitants of the region, and checking their story with the records of the nearest weather bureau station, there seemed to be no other logical way out of it but to assume that the death of the white oaks was caused by the late freezes of May 26 and 27, 1925.

From information obtained from residents of Bland County the two successive freezes which occurred on these dates were so severe that the crops were frozen back to the ground. Corn which at that time was six to eight inches high was completely frozen back. Grape vines were frozen and turned black and foliage suffered badly. Several dead white oaks, which occurred in strips, were noticed during the early summer of 1926.

The Bland County region is comparatively high and mountainous and is subject to late killing frosts and freezes. According to one of the older residents, a similiar freeze occurred in the same district on the night of June 6, 1856, which also resulted in the killing of many white oak. Records obtained from the Weather Bureau Station at Wythe-

ville, Virginia, show low temperatures of 33 degrees F. and 31 degrees F. on the 26 and 27 of May respectively. The station is some 15 miles from the damaged area and it is very probable that the temperature was actually much lower than this where the killing took place.

The dead timber occurred only in the valleys and hollows, where in the case of frost injury, the damage would naturally be located. The fact that no injury could be found above an imaginary frost line on the ridges is a strong argument that frost was the chief factor in causing the death of the trees. The white oak being in a more succulent condition on the date of the freeze, due to the later appearance of the white oak leaves, actually suffered the most injury. The buds as well as the new leaves must have suffered severe freezing or they would have leafed out again.

There was apparently no indication that either an insect attack or a blight was present which could have been responsible for the death of the trees. The fact that there occurred interspersed among the dead oak an occasional dead hickory or red oak, apparently killed at the same time, and from the same cause, would eliminate the probability of the trees having died either from a blight or an insect attack.

In general, it appeared to be the larger over-mature trees which suffered injury from the freeze. This is borne out by the fact that a stand of young, thrifty white oak in the bottom of a hollow suffered practically no injury, whereas nearby over-mature oaks on the same level were killed. It is believed that practically all of the loss of oaks which died due to the effects of the spring freeze of 1925, had already been realized by the summer of 1926, although a very few oaks which had retained but a small portion of their foliage would be expected to die in the next few years.

It may be that the drought which was generally prevalent throughout this region during the summer of 1925 was an important factor in their death, however, we find most of our drought-killed trees up on the ridges where the rocks crop out near the surface and the soil is thin.

Over-maturity, drought, disease or freeze? I am inclined to lay the damage at the door of Jack Frost.

JAMES A. BEAL

SOCIETY AFFAIRS

What the Sections Think of Increased Dues

APPALACHIAN

"After a discussion of Society finances the members of the Section present (at the summer meeting of the Section, July 23, 1926) formally expressed themselves as favoring an increase in Society dues in an amount sufficient to balance the budget and provide for needed activities, the amount of such increase not to exceed seven and four dollars for Senior Members, and Members respectively."

H. R. CONDON, *Secretary-Treasurer.*

CALIFORNIA

"The proposed increase in the dues of the parent Society was again discussed (at a meeting on September 24, 1926). Last September the Section voted to support an increase of dues to a reasonable amount, say, $7.50 for Members and $12.00 for Seniors. It was the sense of the meeting that nothing had occurred to warrant a change of mind; the secretary was therefore instructed to reaffirm to the president its willingness to support an increase in dues. It was the opinion that the parent Society can not function properly and can not make progress without a paid secretary and that to obtain such a secretary, the dues must be raised."

EMANUEL FRITZ, *Secretary.*

INTERMOUNTAIN

"We have some members who certainly will not stand any increase in dues without the privilege of voting. In talking to prospective members the voting question is raised in practically every instance and the question of dues in all cases. The present members of the Intermountain Section do not propose to try to get additional members until the question of dues is definitely settled."

R. E. GERY, *Secretary.*

NEW ENGLAND AND NEW YORK

"At our meeting at Breadloaf, Vermont, (joint meeting of New England and New York Sections, August 22-26, 1926) the following vote was taken: 'That the Executive Council be asked to again hold a referendum on the question of the advance of dues, said advance to be sufficient for the employment of a full time secretary.'"

H. O. COOK, *Secretary.*

ROCKY MOUNTAIN

"The Section is not in favor of increasing the dues because it can not hold its membership if this is done."

E. W. Tinker, *Chairman.*

What the Members and Sections Think of the Society Policy

Dear Mr. Dana:

Reference is made to your letter of April 14.

Activities of the Intermountain Section of the Society of American Foresters have practically ceased during the past three or four years. This has been due to the very scattered condition of our membership and to the fact that so far as the members in the City of Ogden are concerned field travel has been so great that there has not been a time when any considerable number of the members could be gotten together. We are definitely planning on reviving the Society activities next winter but are somewhat at a loss to know just what to do. There are a number of men in the District who are not now members and who will be glad to join if the present schedule of dues remains in force. As we understand it this is settled and unsettled. We take it from your letter of April 14 that while the action at the annual meeting was definite, nevertheless, the probabilities are that the question will again reopen and strong pressure is being brought to bear to increase the annual dues. We have some members who certainly will not stand any increase in dues without the privilege of voting. In talking to prospective members the voting question is raised in practically every instance and the question of dues in all cases. The present members of the Intermountain Section do not propose to try to get additional members until the question of dues is definitely settled.

Practically the entire membership in the Intermountain Section of the Society consists of Forest Service men and practically the entire benefit which they receive from membership in the Society is the receipt of the magazine, and so far as the benefit is concerned, it is about all that they can look forward to in the future. They are doing all that they can to foster forest activities as members of the Forest Service and naturally can do no more whether they are members of the Society or not. I think it is safe to say that the membership in this section will not be increased at all and probably will be decreased by material raise in the annual dues. On the other hand, there is no doubt that we can

materially increase the membership in this territory if the dues remain as at present and we have assurance that they will, and if members are allowed to vote and hold office. As a matter of fact, of course, no one in this section is running for any office nor will, but the idea of "taxation without representation" is not popular.

Full report on private forestry is being sent to Shirley W. Allen. I think we have cleaned this up without the necessity for further study or the appointment of special committees.

The Forest Service put over the American Forest Week campaign in good shape this year.

The members of this section are standing squarely behind Colonel Greeley's position on grazing legislation. We do not approve the stand taken by the Society on the revised grazing bill, nor of all of the statements made by Chapman's committee.

Very sincerely yours,
R. E. GERY,
Secretary Intermountain Section, Society of American Foresters.

Dear Mr. Gery:

Your letter of June 30 has only recently come to my attention on my return from several months in Europe. You are right in your understanding as to the present status of the dues problem. The ballot last year resulted in the definite rejection of the proposed increase in dues. The question is, however, still under consideration, and it is probable that another ballot will shortly be submitted by the Executive Council, which, of course, in that case would hope for favorable action.

I can see no reason why there should be any serious discussion within your section of "taxation without representation." The proposal made last year by the Executive Council that members be given the same voting privilege as Senior Members was approved and the result of the ballot published on page 325 of the March issue of the Journal of Forestry. It is true that the change in the constitution does not give Members the right to hold office, but so far as can be judged from the comments received this is a privilege for which few of the members themselves care.

I appreciate fully the difficulties which such a section as the Intermountain one is up against on account of its scattered membership, so many of whom are members of the Forest Service, but I hope that in spite of this your plans to make the Section more active during the coming winter will be successful. I wish that it were possible in some way to change the common attitude that the sole purpose of membership

in the Society is to get something out of it personally, and also to bring about recognition of the fact that in promoting the progress of forestry generally the Society is actually performing a service to its individual members which, though perhaps intangible, is none the less real.

I am very glad that you were able to submit a full report on private forestry so promptly. It is hoped that this survey will result in giving us a far better picture of just what the present situation is than we now have. With best wishes, I am

Very sincerely yours,

S. T. DANA, *President.*

Treasurer,
Society of American Foresters,
Washington, D. C.
Dear Sir:

I have Detwiler's letter of August 23 requesting me to fulfill my pledge of last year, which was made on the basis of other individual pledges being sufficient to undertake a certain definite program. I do not see from anything said in this letter, that my "requirement" has been met in any degree. Further, Detwiler states that the budget of this year is $1,000 below the income from dues and subscriptions. It does not seem, therefore that it will be necessary to dip into the reserve fund.

I am not quibbling over words and I shall not quibble long over the amount of my pledge when I can see any definite objective to be attained through a voluntary subscription. I have the feeling, however, that the Society membership at large doesn't know what it wants or where it is heading. Despite the splendid leadership of the past two years, the membership has not been "professionally" awakened. Something more is needed, some more concrete objective. I am very keenly interested in the development of a professional spirit, professional pride, professional ethics and ideals among foresters, and I will do anything within my capacity to help advance these things. On the other hand, I am not an "organization man" in the sense that I believe the Society, or any similar organization, is a vital necessity. It must, at least, *make itself* a necessity before it can be considered as such. I would hesitate to make the outright declaration that in the profession, in the membership of the Society, and its leadership past and present, the thing lacking is an ethical ideal (something more or less emotional, perhaps, but still necessary) but I have a very strong feeling that such is the case.

You have asked me for constructive suggestions in the Society's affairs. If the idea I have expressed above is worth thinking about, let the Society assume a definite leadership toward some non-material goal,—such as the development of ethical standards, or "professional enthusiasm" or anything you want to call it,—any goal except propoganda for forestry and foresters, and "being helpful to its members,"—any direct objective, but, for God's sake let it take a stand on something. It may be necessary to drop the idea of "supporting" the Society by heavy increases in the membership (there is obviously something wrong when existing members want to shift the financial burden by "admitting more men of the forest ranger class," as was suggested by the Denver section) and attempt to be a little bit discriminating. It may be necessary to develop pride in the profession and the organization by means which some will readily call "undemocratic." If the Society is to exercise leadership it certainly must not be weighted down with too much dead material.

Let these things be started, a worth-while, idealistic goal set, and I do not think the membership will be appealed to in vain to support a Journal in which they may take interest and pride, or any other worthy thing the Society may need.

You are at liberty to use this letter in any way you may see fit, provided only you do not use it piece-meal. As it is really an appeal to the present officers. I am sending a copy direct to President Dana.

Very truly yours,

C. G. Bates.

Dear Mr. Bates: October 6, 1926.

Thank you for your letter of September 21st. I could not acknowledge it earlier owing to absence from Washington. I feel, as you do, with regard to the Society concentrating on that which will develop professional spirit and professional ethics and ideals. If more members will give as much thought to the advancement of the work of the Society as you evidently have, we will accomplish something worthwhile. I do feel, however, that the job has gotten to the point where we must have a full-time paid secretary of the proper calibre if we are really to make progress.

I am sending your letter to President Dana in case he did not receive the copy which you sent him, and I hope that he will be able to use it along with many other expressions of opinion which have been coming in.

Sincerely yours,

S. B. Detwiler, *Treasurer.*

Amherst, Massachusetts
November 18, 1926

Mr. C. G. Bates,
Rocky Mountain Experiment Station,
Colorado Springs, Colorado

Dear Mr. Bates:

I am very sorry to have been so long in acknowledging your letter of September 28 to the treasurer which you stated was really an appeal to the officers of the Society. This will receive careful consideration at the annual meeting of the Executive Council, which would, I am sure, be glad of more specific suggestions as to the goal or goals which you would recommend. Meanwhile I am venturing to send you my personal reaction on some of the points you raise.

First of all, I think that you are right in believing that more "professional enthusiasm" is one of the great needs of the Society. The question is how to arouse it. Mere talk and the passing of resolutions will not get us far. The development of ethical standards is important, but I am skeptical as to how much enthusiasm it will generate. To my mind there is more promise in continued insistence by the Society on the importance of better forest practice coupled with real efforts to bring such practice about. There is nothing like joint action in behalf of a worthy cause to foster idealism and enthusiasm. If foresters will stand up as a body for the faith that is in them, and do their best to translate that faith into works, we need have no uneasiness as to the future of the Society.

I do not share your apparent objection to "being helpful to its members" as one of the objects of the Society. There is unquestionably a strong demand for such help which seems to me entirely legitimate. At the same time I should not like to see efforts in this direction absorb too much of the Society's energy, particularly since I believe that in the long run activities of the sort discussed in the previous paragraph will prove even more helpful to the members themselves. As I see it, a society with as broad a field and composed of members with as diversified interests as ours must have a well-balanced and reasonably comprehensive program. I have previously stated that in my judgment this program should include the development of high standards of professional conduct and ability, advancement of forestry as a science and an art, establishment of forestry in its proper place in the national life, and service to members.

With proper organization there would be no insuperable obstacle

to simultaneous and effective progress in all of these fields. This, however, requires greater financial resources than are now available. Like you, I should not be greatly alarmed if the increased dues necessary to provide them were to result in a temporary decrease in numbers. I am not at all sure that the Society would not be better off with a smaller but more closely knit, more enthusiastic, and more devoted membership and I believe that most of those who dropped out would in time be only too glad to return to the fold.

No doubt the Executive Council has not yet gone as far as it might in exercising the sort of leadership and in awakening the membership professionally to the extent that you desire. I believe that it has, however, gone far enough in developing and securing general approval of concrete policies and programs to justify the proposed increase in dues. Favorable action on this proposal will not bring the millennium, but it will, I feel sure, mark a decided step forward in the development of the profession.

Very sincerely yours,
S. T. Dana, *President.*

Denver, Colorado
November 10, 1926

Dear Mr. Dana:

This letter is in reply to yours of April 13 last, the last paragraph.

During Mr. Peters' visit to Denver in September, a special meeting was called of the members of the Section then in Denver. Although there were only seven present, the meeting brought forth some good discussion of the subject of finances and Society expansion. It is the basis of this reply.

The Society program has failed to sell itself in this Section because it has failed to show where it would be of any increased value to the members personally, selfish as foresters. This is logical. The purpose of the Society is to advance the profession. To the extent that it does so, it will merit our support, not only on paper, but also in money and effort. It is an empty sophistry to appeal to any sort of sentiment of blind loyalty, since, from a practical standpoint, the Society means little to lots of its western members other than a professional magazine. Even that magazine is found in numerous Forest Service libraries and is available without charge. Hence, the annual dues now amount, in the minds of many members, to a gift to a far-off, vague cause which has nothing in common with the member but a name.

Quite naturally he resents increasing this gift out of his none too ample income. We feel that the Society has no rightful hold of loyalty on its members, except as it merits it through achievement. We hasten to assure you, nevertheless, that we are eager to work with all other Sections for this achievement on a practical basis.

We feel that the genius of the Society should be more that of the practical forest operative and less that of the removed administrative, technical theorist and teacher. In the West we are practicing forestry on the ground. Therefore, we have to work under the same conditions under which forests grow. This imposes arduous outdoor work, isolation and does not conduce toward finished literary expression nor frequent gatherings. And yet, these of ours are essential fundamental forest conditions which should be A B C to any one who interests himself in the subject. We can not help feeling that the lack of understanding which brands it provincial and unprofessional is itself fatally out of sympathy with our common cause, and unwholesomely effete.

We feel that the Society should expand. But we do not feel that it should do so by placing an unduly high premium on the honor of membership and then taxing that honor as an intangible. We favor increasing the membership, making the member grade "par" and making the senior member grade somewhat more of a distinction than it is now. Increased numbers will make increased enthusiasm and that is the *sine qua non,* so far as finances are concerned. Many of our best foresters in this Section are located in outlying communities. They are unable to attend meetings or have any contact with the Society. If our membership included the practical, capable men with whom such members are associated, small local meetings could be held which would contribute greatly to the life of the Section. Special meetings could be called by Section officers in connection with their travels, too.

We favor the establishing of a student grade and the installation of student Sections as honorary societies, with the hope of affiliating present secret honorary fraternities. It is our belief that the induction into the Society as a recognition of high standing in school would establish a feeling of loyalty and enthusiasm which would build toward the sort of loyalty we need in our present member and senior member grades now. If a man in school were permitted to wear the badge as a sign of distinction, he would continue to do so after he got out. At present, very few even own pins and few of those who do consider it worth while to wear them.

We have spoken frankly and sincerely for what we consider the good of the Society.

We do not favor activity of the Society on any large scale in American Forest Week. All of our members are doing as much as they can through other affiliations. We think it advisable to reserve Society funds and efforts for work of a nature which these other organizations are not equipped to carry on.

The Section is not in favor of increasing the dues because it can not hold its members if this is done.

Very sincerely yours,
E. W. TINKER,
Chairman, Rocky Mt. Section, Society of American Foresters.

Amherst, Massachusetts
November 18, 1926

Dear Mr. Tinker:

Please accept my thanks for your frank and helpful letter of November 10. Such expressions of opinion are exactly what the Executive Council desires as a means of keeping it in touch with the views and desires of the Society membership in all parts of the country. I hope that you and other members of the Rocky Mountain Section will not take it amiss if in reply I try to make you see more clearly the point of view of the Executive Council.

We regard the Society as much more than a mutual benefit organization. Its object is rather to promote the development of forestry in the broadest sense of the term. The encouragement of high standards of individual conduct and achievement, advancement of forestry as a science and an art, efforts to bring about the actual practice of forestry, leadership in securing the adoption of sound public policies, the establishment of forestry in its proper place in the national life, —these are as important goals as the rendering of direct service to the individual member. Moreover, in the long run they will probably mean even more to him from a purely selfish standpoint by providing more and better opportunities for employment.

So far as I am aware the Executive Council has never appealed for support of the Society on the basis of blind loyalty to a far-off, vague cause. We have appealed to foresters to support their own professional organization on the ground that it has a unique opportunity for definite service to the nation and to its members of which it can not take advantage with its present resources. The achievement

that your Section rightly demands is possible only if these are increased. Our plea is therefore for sufficient funds to place the Society's present activities on a business-like basis and to add to publication of the JOURNAL OF FORESTRY other activities which will be equally worth while.

It is the judgment of the Council that far more enthusiasm will be generated by the adoption and carrying out of a constructive program than by any mere increase in numbers. If that proposed is not satisfactory, concrete suggestions as to its improvement are always welcome and will receive most careful consideration. Whatever the program adopted, it should be clearly recognized that its success will depend largely on the extent to which the membership as a whole participates in its execution. An executive secretary is needed not so much to act and to speak for the Society as to handle effectively its business affairs and to enable it to act and speak for itself by guiding, correlating, and stimulating section and committee activity.

The Council recognizes fully that the isolated conditions under which many foresters work prevent their regular attendance at meetings and somewhat obscure the advantages of membership in the Society. At the same time it is unable to comprehend the point of view of those who regard a subscription to the JOURNAL OF FORESTRY as a "gift," and who fail to see that any activity aimed at the development of forestry through the united action of the profession is not only worth while from an altruistic standpoint but is to their personal advantage. I should like, however, to urge those who have this attitude to vote favorably on the proposed increase in dues if only as an experiment. They can not feel that membership means much to them under present conditions, and may be agreeably surprised to find that a revivified Society will give them a new sense of pride in and value received from their professional organization. Personally I am confident that a more active Society will more than justify the increased financial support which it will require. Isn't it worth trying?

Very sincerely yours,
S. T. DANA, *President.*

Dear Mr. Porter, Chairman, August 20, 1926
New York Section.

Our recent talks as to program for the New York Section of the Society, and particularly the program of the coming joint meeting of the New York and New England Sections, which I regret keenly that

I shall be unable to attend, have brought to mind again the very important question of the objectives of the New York Section and of the Society as a whole.

Naturally, after service of 25 years as a forester in this country, and particularly after 6 years of organization work in a wood-using industry, where a constant fight has been made for forestry, I have given a great deal of thought to our professional organization, its present status, and its future. You might be interested in my personal thought as to the objectives before our Section and the Society as a whole. May I list them as they come to me:

1. Maintaining professional standards, which should result in the working out by the Section and the Society of a strong code of ethics. The development of definitions and standards must be a part of the development of any profession.

2. Making the profession more attractive by raising standards of income for foresters and establishing satisfactory position among the technical and professional men in the country. The absurd idea that a technical forester must live in poverty to be a good forester must be put into the background. Foresters must be put on to a salary basis comparable with other engineering professions.

3. Education of foresters. There is no organization as well equipped to watch the development of the education of foresters as our Section and the Society. We must keep constantly before us the question as to whether our schools are keeping abreast of the needs.

4. Foster and co-ordinate research.

5. Public relations. The Section and the Society must take a more aggressive part in the development of public sentiment and right legislation. We must be ready to take position in legislation and to give help in the passage of what we believe to be right legislation. We can learn much from the American Chemical Society and other similar organizations in this matter.

6. Better contact and acquaintanceship among members. Good fellowship will make for the kind of respect and regard fundamental in the right development of professional men.

7. Practice forestry. We must practice what we preach and insofar as we are able must be ready to take the risks we are asking owners of timberlands to take. This is not possible for all foresters but land ownership is easy and the forester must not be afraid of practicing his profession at home.

These suggestions as to objectives are rather hastily jotted down

and further thought might change sequence considerably. Anyway, let us have a statement of the objectives and a program.

Very truly yours,
HUGH P. BAKER.

Dear Mr. Detwiler:

(Extract)

My only suggestion to offer to the Council is a constant repetition and hammering on the Society for a permanent Secretary, and with him, an adequate increase in dues. The laissez-faire attitude of the membership is disappointing. Contentment with things as they are and the unwillingness to progress with the other professional and technical associations means retrogression.

A couple of years ago I had the opportunity of canvassing some 30 to 35 Foresters relative to membership in the American Forestry Association. Unless I remember incorrectly, three out of the entire group had evinced sufficient interest in the popular phases of the forestry movement to subscribe even to the magazine.

We won't follow the advice and pleadings of our own leaders in the Society. We won't as a group contribute to the only Forestry organization in the United States that reaches the mass of the people. Is the charge true that we are interested only in ourselves and our own jobs,—that we expect others to fight our battles for us in the advancement of the profession and the forestry movement? If it be so, then we as a group need to be shaken for our complacency. This can be accomplished in two ways,—first, by a cataclysm of some kind that might threaten the whole forestry movement; and second, the slow and possibly the ineffectual method of constant repetition and constant hammering in the pages of the JOURNAL.

I had thought the clear-cut statements of the members of the Society and of the Council were sufficient,—evidently not. Keep them up. In the meantime, why not prepare a table showing the annual dues and the general policies of the leading engineering and scientific societies and associations that the membership may see we are falling sadly behind the other professional societies.

After all, has the Society as an organization ever accomplished anything worthwhile in the furtherance of the Forestry movement? Has it been of as much value to the people of the country as the American Forestry Association? If not, why? I am not asking these

questions from a standpoint of criticism, but as a member endeavoring to clarify in his own mind the possibilities of the Society. I wonder if the presentation of a few questions of that kind to the membership might not lead to considerable introspection and worthwhile consideration of those things the Council has been endeavoring to put over for the last two or three years.

T. C. Spaulding,
Dean, School of Forestry, University of Montana.

Extract from Report of 1925 Auditing Committee

"Your committee feels that it is very important that the business of the Society be recorded in an adequate and complete accounting system as soon as possible. Because it also realized the lack of available funds it has tried to make this system as simple as possible. The system outlined is really more simple than it would seem from reading the report and when it is once set up and thoroughly understood it will consume little, if any, more time than the present records. If the Executive Committee approves the system and if funds are available for hiring the necessary office help so that it will not be necessary for the Executive Secretary to spend his own time keeping these records: it is recommended that the necessary books be purchased and the system be put in operation January 1, 1927. If this can not be accomplished by that time your committee recommends that for the year 1927 only the Journals and such ledger accounts as are controlled by budgets be set up and that preparations be made for adopting the system as a whole January 1, 1928.

"It is hoped that in the near future the Society will realize that it is no longer an infant Society which can live in and be fed in its childhood home. The young eagle has to be pushed out of the nest before it learns to fly. The Society has reached the same stage. It is now grown to the point where if it has the courage and faith it can step out and do big things for advancement of forestry as a profession. There are other organizations which are trying to advance forestry as a movement but none of which are trying to make the forestry profession powerful and influential as a profession. None of these other organizations are trying, nor should they try, to create a demand for foresters to aid in the solution of big problems in fields the forester has not yet entered except in a purely technical capacity. Nor are these organizations making any effort to open the eyes of the forester that he may see and get ready for these new opportunities for service and professional advancement.

"When the membership as a whole sees the possibilities there will be funds available to put a man with a big vision and capacity to put that vision across on the job as Executive Secretary and to give him funds enough to run his office so that he will not have to spend his own time on details of a clerical nature. In the preparation of this accounting system your committee has been looking forward to the time when these things shall be possible."

B. A. Chandler, *Chairman*
S. B. Detwiler, *Auditing Committee*

Committee on Professional Conduct

Last spring the Executive Council voted to organize a committee on Professional Conduct the members of which are as follows: W. L. Hall, Chairman; F. W. Besley; F. G. Miller; H. F. Weis; T. S. Woolsey, Jr.

It is apparently the general sentiment of the Society that we are not yet ready for a written code of ethics, but that we should be making progress toward the development of such a code through the consideration of specific problems. The committee on Professional Conduct will assist the Executive Council in passing upon specific charges brought against any member of the Society, but its main object is to focus attention on the importance to the profession of maintaining a high standard of ethics and to provide a means for the consideration and formulation of such a standard without the necessity of actually preferring charges. The committee will serve as a body to which anyone in doubt as to the propriety of any action, in either an actual or a hypothetical case, can present the matter for advice. The decision of the committee in such cases will ordinarily be published without names, and will serve to establish precedents for the guidance both of the Society as a whole and of individual members. It is hoped that members of the Society will take advantage of this opportunity to secure advice concerning questions on which they may be in doubt.

The following correspondence offers a specific example of the sort of advice which the committee is ready to give:

September 21, 1926

Dear Mr. Hall:

I should like to secure the advice of the Committee on Professional Practice on the following question:

The committee on the administration and award of the Charles Lathrop Pack prize is appointed by the president of the Society. The

committee has decided that all papers in competition for the prize must be submitted anonymously so that the authors of the competing papers are not known until after the award has been made. Under these circumstances, is it ethical for the president to compete for the prize? An early reply would be much appreciated.

Very sincerely yours,
S. T. DANA, *President.*
September 27, 1926

Dear Mr. Dana:

Replying to your letter of the 21st I think the plan adopted for awarding the Charles Lathrop Pack prize rests on the basic idea that all members should share equally the privilege of entering the competition. So far as I can see there is nothing in the rules of the contest nor is there any precedent that would make your entry at all subject to criticism.

So much from the viewpoint of the Society. From your viewpoint as President of the Society, careful as I know you are to set no precedent that might ever lead into an embarrassing situation, I feel that you may decide that it will possibly safeguard the best interests of the Society by withholding your entry from the competition. So doing you would set for the Presidency a very high example that would tend to become a precedent for all such matters.

Very sincerely yours,
WM. L. HALL,
Chairman, Committee on Professional Conduct

* * * *

The foregoing statement by President Dana clearly defines the work of the committee. Questions, problems or situations on which members desire advice from the committee may be submitted through the Executive Secretary of the Society or to the Chairman of the committee direct.

WM. L. HALL, *Chairman*
522 Spring Street
Hot Springs, Ark.

JOURNAL OF FORESTRY

OFFICIAL ORGAN OF THE SOCIETY OF AMERICAN FORESTERS

VOLUME XXIV

With Six Cuts and Thirty Three Diagrams

PUBLISHED BY THE

SOCIETY OF AMERICAN FORESTERS

AT 930 F STREET N. W.

WASHINGTON, D. C.

1926

JOURNAL OF FORESTRY

A professional journal devoted to all branches of forestry

EDITED BY THE EDITORIAL BOARD OF
THE SOCIETY OF AMERICAN FORESTERS

The Journal appears eight times a year monthly—with the exception of June, July, August and September.

The pages of the Journal are open to members and non-members of the Society.

Manuscripts intended for publication should be sent to Raphael Zon, Lake States Forest Experiment Station, University Farm, St. Paul, Minn., or to any member of the Editorial Board.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Subscriptions, advertising and other business matters may be addressed either to the Journal of Forestry, University Farm, Saint Paul, Minnesota, or to Atlantic Building, 930 F Street N. W., Washington, D. C.

CONTENTS

INDEX

Art. = article; rev. = review; c. l. = current literature; n. = note; s. a. = society affairs; ref. = reference.

Sections of the Society of American Foresters for 1926

Allegheny

C. P. Wilber, Chairman, State Forester, State Office Building, Trenton, New Jersey.
G. H. Wirt, Vice-Chairman, Department of Forests and Waters, Harrisburg, Pa.
H. R. Condon, Secretary-Treasurer, Broad Street Station, Philadelphia, Pa.

California

C. L. Hill, Chairman, 1408 Grand Ave., Piedmont, California.
Emanuel Fritz, Secretary, 305 Hilgard Hall, Berkeley, Cal.

Central Rocky Mountain

E. W. Tinker, Chairman, Forest Service, Denver, Colorado.
J. W. Spencer, Vice-Chairman, Forest Service, Denver, Colo.
H. D. Cochran, Secretary, Forest Service, Denver, Colorado.

Intermountain

R. E. Gery, Secretary, Forest Service, Ogden, Utah.

Minnesota

Henry Schmitz, Chairman, University Farm, St. Paul, Minn.
S. A. Graham, Secretary, University Farm, St. Paul, Minn.

New England

Karl W. Woodward, Chairman, New Hampshire University, Durham, New Hampshire.
H. O. Cook, Secretary, State House, Boston, Massachusetts.

New York

O. M. Porter, Chairman, c/o American Paper & Pulp Association, 18 East 41st St., New York City, New York.
John Bentley, Jr., Secretary, Cornell University, Ithaca, New York.

Northern Rocky Mountain

R. H. Weidman, Chairman, Forest Service, Missoula, Montana.
W. M. Nagel, Secretary-Treasurer, Missoula, Montana.
T. C. Spaulding, 3rd member of the Executive Committee, Missoula, Montana.

North Pacific

A. W. Cooper, Chairman, c/o Western Pine Manufacturers Assn., Yeon Building, Portland, Oregon.
A. H. Hodgson, Secretary-Treasurer, U. S. Forest Service, Portland, Oregon.

Ohio Valley

Ovid A. Alderman, Chairman, Wooster, Ohio.
Bernard E. Leete, Secretary, 1313 Kinney's Lane, Portsmouth, Ohio.

Southern Appalachian

E. F. McCarthy, Chairman, Room 610, New Medical Bldg., Asheville, N. C.
R. S. Maddox, Vice-Chairman, State Forester, Nashville, Tenn.
F. W. Haasis, Secretary, Appalachian Forest Experiment Sta., Asheville, N. C.

Southwestern

Hugh G. Calkins, Vice Chairman, U. S. Forest Service, Albuquerque, New Mexico.
Quincy Randles, Secretary, Forest Service, Albuquerque, New Mexico.

Washington

G. H. Collingwood, Chairman, Forest Service, Washington, D. C.
Franklin W. Reed, Vice-Chairman, 3245 Cleveland Ave., N. W., Washington, D. C.
John B. Cuno, Secretary-Treasurer, Forest Service, Washington, D. C.

Wisconsin

B. H. Paul, Chairman, Forest Products Laboratory, Madison, Wisconsin.
E. M. Davis, Secretary-Treasurer, Forest Products Laboratory, Madison, Wisconsin.

CONTENTS